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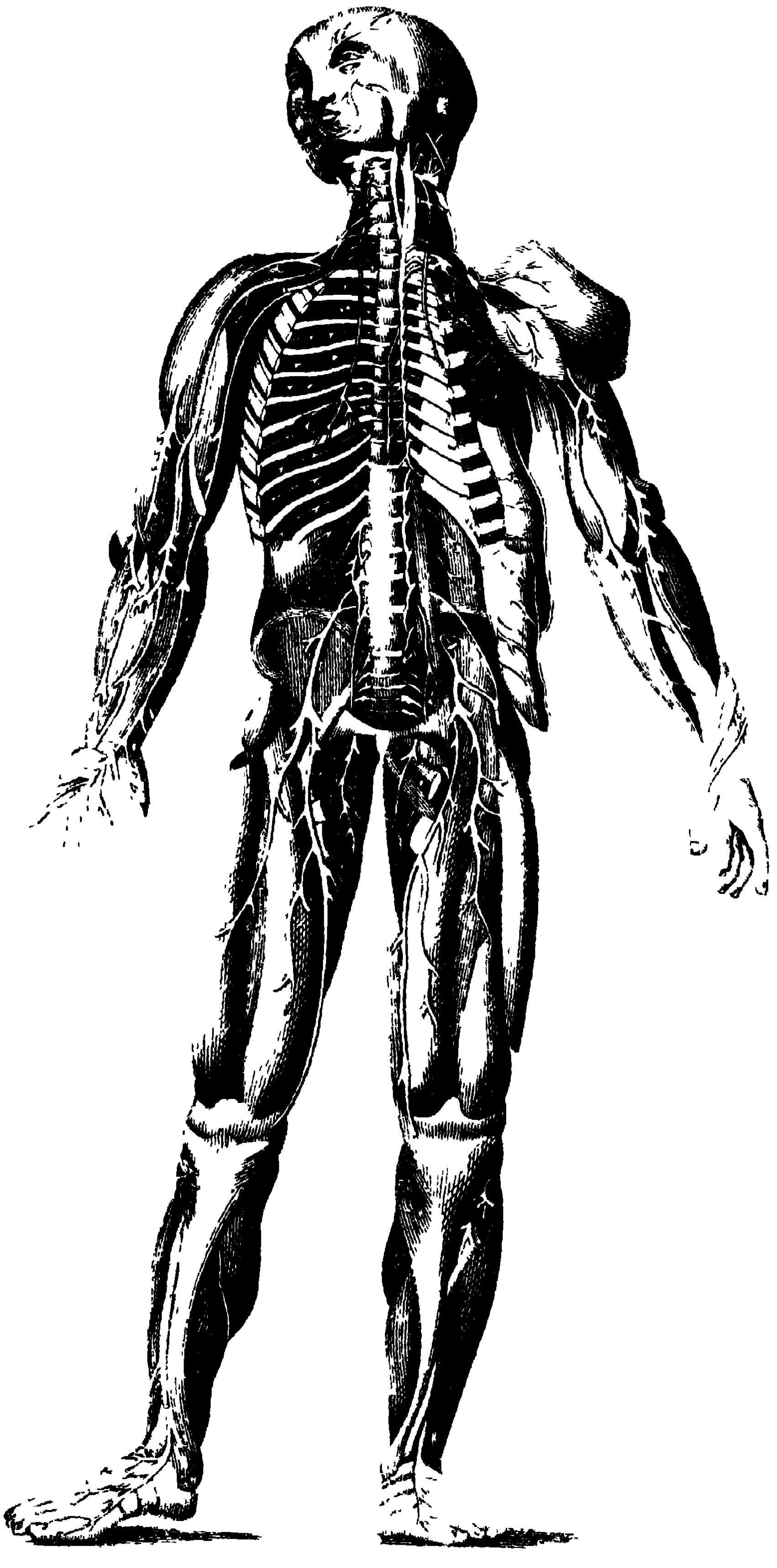

THE
EDINBURGH SCHOOL
OF
MEDICINE:

CONTAINING THE
PRELIMINARY OR FUNDAMENTAL BRANCHES
OF
PROFESSIONAL EDUCATION,
VIZ.
ANATOMY, MEDICAL CHEMISTRY, AND
BOTANY.

Intended as an
INTRODUCTION TO THE CLINICAL GUIDE.

THE WHOLE FORMING A COMPLETE SYSTEM OF MEDICAL
EDUCATION AND PRACTICE ACCORDING TO THE
ARRANGEMENT OF THE EDINBURGH SCHOOL.

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IN FOUR VOLUMES.

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PREFACE.

IN the volumes which have been publiſhed under the title of the CLINICAL GUIDE, the object of their Author has been to form, as it were, a ſet of School Books for the Student of Medicine, which may prove of the ſame utility in the ſtudy of this ſcience, as ſuch elementary pieces are in the earlier part of life to the acquiſition of the languages, and the other parts of primary knowledge. By this means, the ſtudent is at once initiated into a general acquaintance with the ſubjects he is afterwards to purſue in detail; and again, when fully acquainted with them in detail, he can recur to the ſame elementary pieces in order to recall to his mind the extent of the ſubjects which have occupied his attention, and which, in the hurried routine of practice, he is apt in many leading particulars to forget. This intention of the Author has been ſo far executed in the volumes that have already appeared, and the Public has ſanctioned the deſign by their favorable reception; but, to complete the plan, and render the work a full ſyſtem of Medical Education, the preliminary branches which form the foundation of the profeſſion become a neceſſary and indiſpenſible introduction. Theſe branches comprehend the principles of Anatomy, of Chemiſtry, and of Botany, conſidered ſtrictly in a medical view. The execution of this laſt part is now brought forward. In performing it, the great object the Author has had in view, has been to follow the arrangement of that celebrated School, which has ſo much benefited the Profeſſion; and by the labours of whoſe teachers Medicine is no longer to be conſidered in the light of a conjectural art. The Hiſtory of the Edinburgh School may be conſidered as the Hiſtory of Medicine in modern times; and, from the era of Boerhaave to the preſent day, it has regulated in a great meaſure the views of Medical practice. The firſt, to whom this Univerſity was indebted for its Medical reputation, was the late Dr. Monro, who was not only the founder of the Anatomical department, ſo ably extended and improved by his ſucceſſor, but was the original promoter of the Clinical Lectures, a mode of conveying practical ſcience ſuperior to every other, and ſince followed in every Medical ſeminary. But, though Monro was ſeconded by ſome men of abilities, they were too much attached to the Boerhaavian tenets, to take thoſe new views of their particular departments which were reſerved for their ſucceſſors. Rutherford, cautious and ſlow, purſued the beaten track of regular, and, at that time, approved practice. Plummer filled the Chemical Chair as an able commentator on the leſſons of his maſter, and invented that combination of antimony and mercury which ſtill retains his name. It was the introduction of Cullen into this Univerſity that changed the face of Medical Science. While the Lectures of the Dutch Æſculapius had given to Medicine a ſcientific, but often a fanciful form, it was reſerved for the Edinburgh School, through him, to introduce into it inductive reaſoning, to build on the foundation of Newton and Locke, and to ſubſtitute facts for ſpeculative opinion. In doing this, Cullen was ably ſeconded by his colleague, the late Dr. Gregory; who, with the acquiſition of profeſſional ſcience, was zealous alſo to blend the duties of profeſſional character. The joint labours of theſe colleagues being ſucceſſively devoted to teaching the Theory and Practice in rotation, afforded to the ſtudent different views of the ſame ſubject, and allowed him to appreciate the relative merit of each. The ſame variety was likewiſe afforded him in conducting the Clinical Lectures, and the opinions of the different teachers were thus ſubjected to the teſt of practice, and their comparative merit as Clinical Phyſicians brought forward. Nor, while the Theory and Practice were thus ably ſupported, were the other branches of Medical Science left behind, the Chemical Chair was reſigned by Cullen to the illuſtrious Black, and the Anatomical Theatre received an increaſe of fame from the deſcendant of Monro. Botany was taught on an extended ſcale by the patient aſſiduity of Hope, and a garden raiſed under his inſpection, equal, if not ſuperior to any in Europe. To the abilities of theſe men alone, does the

School of Edinburgh owe its reputation. While Cullen gave a new form to reaſoning in Medicine, Black gave ſcience to Chemiſtry. Monro detected many of the minute parts of the animal ſtructure which had not hitherto been completely aſcertained, and Hope extorted the applauſe of diſcovery in Botany from the indefatigable genius of Linnæus.

In the following work we have endeavoured to reap every advantage from the Leſſons of this School, and to purſue the arrangement which has been generally adopted in it. Not that we have neglected to take the benefit of the diſcoveries of others elſewhere, or that we have excluſively wn a blind veneration for the doctrines of that ſeminary; but it will readily be allowed by every competent judge, that no where is Medicine taught ſo ably as a ſcience as in that Univerſity, and no where are its departments ſo well adjuſted as to embrace the full extent of its different objects.

THE

ANATOMICAL GUIDE;

OR,

A VIEW

OF THE

ANATOMY AND PHYSIOLOGY

OF THE

HUMAN BODY,

IN THE

SOUND AND MORBID STATE;

WITH THE

APPLICATION OF CHEMISTRY,

AND THE CHIEF MODES OF ANATOMICAL PREPARATION
WHICH HAVE BEEN EMPLOYED IN ORDER TO
FACILITATE THE EXPLANATIONS OF
ITS STRUCTURE.

a 5

PREFACE.

THE Study of Anatomy, as the foundation of Medicine, is a truth ſo well eſtabliſhed, and ſo univerſally acknowledged, as to leave no room for obſervation. The progreſs it has made of late years is the beſt proof of its acknowledged importance; and the numerous works which have been publiſhed, ſhew the curioſity of its votaries unſated in their deſire of improvement. The object of the preſent publication has already been explained, as forming an introductory part to another work; and it is only neceſſary here to explain the plan that has been adopted in proſecuting the principles of Anatomy.

To combine a knowledge of the human ſtructure, both in a ſound and morbid ſtate, is what the application of the ſubject demands. We of this kind have been generally confined to the former, and the Anatomy of diſeaſe has been therefore lame and imperfect. To include both theſe objects in the ſame treatiſes, has not been attempted in ſuch a manner as to give clear ideas of the latter, and except from the very maſterly work of Dr. Baillie on the Morbid State, where the appearances of diſeaſe are clearly and methodically arranged, little advantage is gained by a ſtudent in conſulting the larger works.

In the following pages, after a ſhort Hiſtory of the Science, we have introduced the ſubject by a General View of the Human Structure, ſo as to give a full idea of its ſeveral parts and their connections; we have then arranged it into its ſeveral diviſions, beginning, as is common, with the baſis of the body, or the Oſteology, from thence proceeding to the ſofter parts, and laſt of all to the Anatomy of Diſeaſe. In finiſhing each part, we have examined the principles of its compoſition ſo far as Chemiſtry has been able to detect them; and, after this examination, we have conſidered the method of preparing it for a more full inſpection, or for the purpoſes of the Anatomiſt.

The ſize of this work does not admit much elucidation of the ſubject by plates. A few, however, are given, which it is hoped will be found correct, and the work may be read along with the beſt plates of different authors on particular parts of the ſubject.

1809

CONTENTS.

INTRODUCTION, . . Page 1
History of Anatomy, . . 2
Different Eras of its Improvement, . 3
General View of the Human Structure, . 9
Its Diviſion into Parts, . . 22

PART. I. DEMONSTRATION OF THE HARD PARTS, OR OSTEOLOGY, . . . 23
General Obſervations on the Structure of Bones, 24
Formation of Bone, . . . 25
Different Theories of it, . . 26
Phenomena attending it, . . ib.
Diviſion of Bones into Claſſes, . 31
General Connection of Bones, . . ib.
Dried Bones, or Skeleton, . . 32
Diviſion of the Skeleton into Head, Trunk, and Extremities, . . . 33
1. Bones of the Head, or the Skull, . ib.
Its Diviſion into Braincaſe, or Cranium, and Face, ... 34

General Appearance and Structure of the Cranium, . . . *Page* 34
Diviſion of Cranium, . . . 35
Sutures of Cranium, . . . 37
Advantages of Sutures of Cranium, . 41
Separate Parts of Cranium, . . 42
Frontal Bone, . . . *ib.*
Parietal Bones, ... 46
Occipital Bone, . . . 48
Temporal Bones, . . . 51
Ethmoid Bone, ... 57
Sphenoid Bone, . . . 60
General Structure of Face, . . 65
Naſal Bones, ... *ib.*
Nail Bone, ... 66
Superior Maxillary Bones, . . 67
Cheek Bones, . . . 71
Palate Bones, ... 72
Inferior Spongy Bones, . . 74
Vomer, ... 75
Under Jaw-bone, . . 76
2. Trunk.
Its Diviſion into Spine, Baſin, and Cheſt, 79
General Deſcription of Spine, . . 80
Separate Pieces of Spine, or Vertebræ, *ib.*
Diviſion of Vertebræ into Cervical, Dorſal, and Lumbar, . . . 81
Deviations in Number, . . 82
General Structure of every Vertebra, . *ib.*
Differences in the ſeveral Diviſions, . 85
Spinal Opening, . . . 88

Intervertebral Cartilage, . . *Page* 89
Motions of the Spine, . . . 90
Deſcription of the Cheſt, . . 91
Diviſion of the Parts of the Cheſt, . *ib.*
General Structure of the Ribs, . *ib.*
Their Number, and Diviſion of the Ribs, 92
Cartilages of the Ribs, . . 94
Deſcription of the Breaſt Bone, . 95
Diviſions of the Breaſt Bone, . . 96
General Deſcription of the Baſin, . 97
Diviſion of the Baſin, . . *ib.*
Sacred Bone, ... *ib.*
Rump Bone, . . . 99
Nameleſs Bones, . . . 100
Haunch Bone, . . . *ib.*
Hip Bone, ... 102
Share Bone, . . . 103
3. Extremities, ... 104
Divided into Superior and Inferior, . *ib.*
Inferior Extremities compoſed of Thighs, Legs, and Feet, ... *ib.*
General Deſcription of the Thigh Bone, *ib.*
Bones of the Legs, . . . 107
Divided into Tibia, Fibula, and Patella, *ib.*
Deſcription of the Tibia, . . *ib.*
Deſcription of the Fibula, . . 109
of the Patella, . . 110
Bones of the Foot, . . . 111
Bones of the Inſtep, . . . *ib.*
Aſtragulus, . . . 112

Heel Bone, . . . *Page* 113
Boot like Bone, . . . *ib.*
Wedge-like Bones, . . . 114
Cuboid Bone, . . . *ib.*
Metatarſal Bones, . . 115
Ranks of Toes, . . . *ib.*
Seſamoid Bones, . . . 116
perior Extremities, compoſed of Shoulders, Arms, and Hands, . . *ib.*
Bones of the Shoulder, . . 117
Shoulder Blade, . . . *ib.*
Collar Bone, ... 120
Arm Bone, . . . *ib.*
Forearm Bones, . . . 122
Radius, . . . 123
Cubit, ... 124
Bones of the Hand, . . 126
Wriſt Bones, Diviſion of into Rows, . *ib.*
Bones of the Firſt Row, . . *ib.*
Scaphoid Bone, . . . *ib.*
Lunated Bone, . . . 127
Wedge-like Bone, . . *ib.*
Pea-ſhaped Bone, . . . *ib.*
Bones of the Second Row, . . *ib.*
Trapezium Bone, . . 127
Trapezoid Bone, . . 128
Large Bone, . . . *ib.*
Unciform Bone, . . . *ib.*
Cartilages of Carpal Bones, . . *ib.*
Metacarpal Bones, General Deſcription of, 129

Bones of the Fingers, divided into Three Ranks, *Page* 130
Differences in the Dried Bones, or Skeleton, *ib.*
From Period of Life. . . 131
Skeleton of the Child, . . . *ib.*
of Old Age, . . . 133
From Difference of Sex, . . *ib.*
Skeleton of the Female, . . *ib.*
From Species, . . . *ib.*
Skeleton of the Negro, . . 137
Chemical Analyſis of the Bones, . . *ib.*
Recent Bones, or Freſh Subject, . 138
Differences from the Skeleton, . . 139
Perioſteum of Bones, . . . *ib.*
Marrow of Bones, . . . 140
Chemical Analyſis of the Marrow, . 142
Teeth, or peculiar Bony Structure, . *ib.*
General Deſcription of, . . 143
Appendages of the Perioſteum and Gums, 144
Diviſion of the Teeth into Inciſors, Canines, and Molar Teeth, . . . 145
Formation of the Teeth, . . 146
Progreſs of their Growth and Protruſion, 147
Circumſtances regulating this, . . . 148
Different Periods of Dentation, . 149
Concluſions on the Structure of the Teeth, 152
Chemical Analyſis of the Teeth, . . *ib.*
Anatomical Preparation of the Dried Bones, or Skeleton, ... *ib.*
Natural Skeleton, . . . *ib.*

Artificial Skeleton, *Page* 154
Anatomical Demonſtration of the Structure of the Bones, 160
Preparation of the Perioſteum, 161

PART II. DEMONSTRATION AND DISSECTION OF THE SOFT PARTS.

Common Teguments, 162
Cuticle, *ib.*
Rete Mucoſum, 164
True Skin, 165
Uſes of the Skin, 167
Appendages of the Skin, 168
Nails, *ib.*
Hairs, *ib.*
Sebaceous Follicles, 169
Miliary Glands, 170
Cellular Membrane, 171
Fat, *ib.*
Uſes of the Fat, 172
Chemical Analyſis of the Common Teguments and their Appendages, 173
Anatomical Preparation of the Teguments, 174
Muſcles, *ib.*
Peculiar Action of the Muſcles, *ib.*
Arrangement of the Muſcles, 178
Muſcles of the Head, *ib.*
  Occipito Frontalis, *ib.*
  Corrugator Supercilii, 179
  Orbicularis Oculi, 180
  Levator Palpetræ Supebioris, 181

Muſcles of the Noſe and Mouth, . *Page* 181
  Levator Labii Superioris et Alæ Naſi, *ib.*
  Levator Labii Inferioris Proprius, . 182
  Levator Anguli Oris, . . *ib.*
  Zygomaticus Major. . . *ib.*
  Zygomaticus Minor, . . . 183
  Buccinnator, . . . *ib.*
  Depreſſor Anguli Oris, . . 184
  Depreſſor Labii Inferioris, . . *ib.*
  Orbicularis Oris, . . . 185
  Depreſſor Labii Superioris et Alæ Naſi, 186
  Conſtrictor Naſi, . . . *ib.*
  Levator Menti, . . . *ib.*
Muſcles of the Ear, . . 187
  Inferior Auris, . . . *ib.*
  Anterior Auris, . . . *ib.*
  Poſterior Auris, . . . *ib.*
  Muſculus Helicis Major, . . 188
  Muſculus Helicis Minor, . . *ib.*
  Muſculus Tragicus, . . *ib.*
  Muſculus Antitragicus, . . *ib.*
  Tranſverſus, . . . 189
Muſcles of the Eye Ball, . . *ib.*
  Rectus Superior, . . . 190
  Rectus Inferior, . . . *ib.*
  Rectus Internus, . . *ib.*
  Rectus Externus, . . . 191
  Obliquus Superior, . . *ib.*
  Obliquus Inferior, . . . 192
Muſcles of the Lower Jaw, . . *ib.*

Temporal Muſcle, . . Page 192
Maſſeter, . . . 193
Pterygoid Muſcles, . . ib.
Muſcles of the Throat and Tongue, . 195
Deſcription of the Os Hyoides, . . ib.
of the Trachea, . . 197
Muſcles of the Throat, . . . 199
Sterno-Hyoideus, . . . ib.
Sterno-Thyroideus, . . ib.
Omo-Hyoideus, . 200
Mylo-Hyoideus, . . . ib.
Genio-Hyoideus, . . [illegible]
Stylo-Hyoideus, . . ib.
Digaſtricus, . . 20[illegible]
Hyo-Thyroideus, . .
Crico-Thyroideus, . . 203
Arytenoideus Tranſverſus, . . ib.
Arytenoideus Obliquus, . . ib.
Crico-Arytenoideus Poſticus, . 204
Obliquus, . ib.
Thyrio-Arytenoideus, . . ib.
Azygos Uvulæ. . . . 205
Levator Palati Mollis, . . . ib.
Circumflexus Palati, . . 206
Conſtrictor Iſthmi Faucium, . . ib.
Palato-Pharyngeus, . . ib.
Pharynx, ... 207
Stylo-Pharyngeus, . . ib.
Conſtrictor Superior, . . 208
Medius, . . ib.

- Conſtrictor Inferior, . . *Page* 209
- Muſcles of the Tongue, . . *ib.*
  - Stylo-Gloſſus, ... *ib.*
  - Hyo-Gloſſus, . . . 210
  - Genio-Gloſſus, . . . *ib.*
  - Lingualis, . . . *ib.*
- Action of the Muſcles of the Jaws, Throat, and Tongue in Eating and Speech, . 211
- Muſcles of the Arm, . . 216
- Muſcles of the Scapula, . . *ib.*
  - Trapezius, . . 217
  - Levator Scapulæ, . . . 218
  - Rhomboideus, . . . 219
  - Serratus Major Anticus, . . *ib.*
  - Pectoralis Minor, . . 220
  - Subclavius, . . . *ib.*
  - Pectoralis Major. . . . 221
  - Latiſſimus Dorſi, . . 222
  - Deltoides, . . . 223
  - Coraco Brachialis, . . 224
  - Supra Spinatus, . . . 225
  - Infra Spinatus, . . . *ib.*
  - Teres Minor, . . . 226
  - Teres Major, . . . *ib.*
  - Subſcapularis, . . . *ib.*
- Action of the Muſcles of the Arm, . 227
- Muſcles of the Forearm, . . 228
  - Biceps Brachii Flexor, . . . *ib.*
  - Brachialis Internus, . . 229
  - Triceps Extenſor, . . . 230

Anconæus, . . . *Page* 230
Muſcles of the Lower Arm and Hand, . 231
Pronator Teres Radii, . . 233
Palmaris Longus, . . . *ib.*
Palmaris Brevis, . . 234
Flexor Carpi Radialis, . . *ib.*
Carpi Ulnaris, . . 235
Digitorum Sublimis, . . *ib.*
Profundus, . 236
Lumbricales, . . . *ib.*
Flexor Longus Pollicis, . . 237
Pronator Quadratus, . . 238
Supinator Radii Longus, . . *ib.*
Extenſor Carpi Radialis Longior, . 239
Brevior, . *ib.*
Ulnaris, . . 240
Digitorum Communis, . *ib.*
Minimi Digiti, . . 241
Primus Pollicis, . . 242
Secundus, . . *ib.*
Tertius, . . . *ib.*
Inductor, . . . 243
Supinator Brevis, . . . 244
Muſcles in the Hand, . . *ib.*
Abductor Pollicis, . . . *ib.*
Opponens Pollicis, . . 245
Flexor Brevis Pollicis, . . *ib.*
Adductor Pollicis, . . 246
Abductor Minimi Digiti, . . *ib.*
Flexor Parvus Minimi Digiti, . . 247

Adductor Minimi Digiti, . *Page* 247
Abductor Indicis, . . . 248
Interoſſeous Muſcles, . . *ib.*
External Ditto, . . . *ib.*
Internal Ditto, ... *ib.*
Action of the Muſcles of the Upper Extremity, 249
Muſcles ſeated on the Ribs, . . 252
Serratus Superior Poſticus, . . *ib.*
Inferior Poſticus, . . 253
Levatores Coſtarum, . . . *ib.*
Intercoſtales, . . . 254
Sterno-Coſtalis, . . . 255
Action of the Ribs, . . . *ib.*
Muſcles of the Head and Neck, . 256
Splenius, ... *ib.*
Complexus, . . . 259
Trachelo-Maſtoideus, . . *ib.*
Rectus Capitis Minor, . . 260
Major, . . *ib.*
Obliquus Superior, . . . *ib.*
Inferior, . . . 261
Motion of the Head, . . *ib.*
Muſcles of the Trunk, . . . 263
Quadratus Lumborum, . . *ib.*
Longiſſimus Dorſi, . . . *ib.*
Sacro Lumbalis, . . . 264
Motions of the Trunk, . . 265
Spinalis Cervicis, . . . *ib.*
Dorſi, . . . 266

Semi Spinalis Dorſi, . . *Page* 266
Multifidus Spinæ, ... *ib.*
Interſpinales Colli, . . 267
Intertranſverſales Colli, . . *ib.*
Interſpinales et Intertranſverſales Dorſi, 268
Interſpinalis Lumborum, . . *ib.*
Intertranſverſalis Lumborum, . . *ib.*
Platiſma Myoides, . . . *ib.*
Maſtoideus, . . . 269
Rectus Internus Capitis Major, . 270
Rectus Capitis Minor, . . *ib.*
Rectus Capitis Lateralis, . . *ib.*
Longus Colli, . . . 271
Scalenus, . . . *ib.*
Muſcles of the Belly, . . 272
Obliquus Externus, . . 273
Internus, . . 274
Tranſverſalis, . . . *ib.*
Recti, ... 275
Pyramidalis, . . . 276
Action of the Abdominal Muſcles, . *ib.*
Linea Alba, . . . 279
Umbilicus, ... 280
Abdominal Ring, . . . *ib.*
Diaphragm, . . . 282
Muſcles of the Genital Parts, and Parts contiguous, ... 285
Erector Penis, . . . *ib.*
Accelerator Urinæ, . . . 286

Tranſverſalis Peronæi, . . *Page* 287
Sphincter Ani, . . . *ib.*
Levator Ani, . . . 288
Coccygæus, . . . 289
Peronæum, . . . *ib.*
Erector Clitoridis, . . . 290
Sphincter Vaginæ, . . *ib.*
Muſcles of the Inferior Extremity, . . *ib.*
Muſcles of the Thigh, . . 291
Faſcia of the Thigh, . . . *ib.*
Muſculus Faſcialis, . . 292
Pſoas Magnus, . . . 293
Parvus, . . . *ib.*
Iliacus Internus, . . 294
Pectinalis, . . . *ib.*
Triceps Femoris, . . . 295
Obturator Externus, . . 296
Glutæi, ... 297
Glutæus Maximus, . . *ib.*
Medius, . . *ib.*
Minimus, . . 298
Gemini, ... 299
Pyriformis, . . . *ib.*
Obturator Internus, . . 300
Quadratus Femoris, . . . *ib.*
Muſcles of the Leg, . . 301
Rectus Femoris, . . . *ib.*
Cruris, . . . *ib.*
Cruræus, ... *ib.*

Vaſtus Externus, . . *Page* 302
Internus, . . *ib.*
Flexors of the Leg, . . . 305
Sartorius, . . . *ib.*
Gracialis, ... *ib.*
Semi-Tendinoſus, . . 306
Semi-Membranoſus, . . *ib.*
Popliteus, . . . 307
Biceps Cruris, . . . 308
Action of the Muſcles of the Leg in Walking, Running, &c. . . . *ib.*
Muſcles of the Foot, . . 311
Gaſtrocnemius, . . . *ib.*
Plantaris, . . . 312
Peronei, ... *ib.*
Peroneus Longus, . . . 314
Brevis, . . 315
Tibialis Poſticus, . . . *ib.*
Anticus, . . 316
Muſcles of the Toes, . . . *ib.*
Flexor Longus Pollicis, . . *ib.*
Digitorum, . . 317
Plantaris Pedis, . . . 318
Flexor Brevis, . . . *ib.*
Lumbricales . . . 319
Extenſors of the Toes, . . 320
Extenſor Longus Digitorum Pedis, . *ib.*
Peroneus Tertius, . . . *ib.*
Extenſor Digitorum Brevis, . 321

Extenſor Pollicis Proprius, . *Page* 321
Muſcles in the Foot, . . 322
Abductor Pollicis, . . . *ib.*
Flexor Brevis Pollicis, . . . *ib.*
Adductor Pollicis, . . 323
Tranſverſalis Pedis, . . *ib.*
Abductor Minimi Digiti, . . 324
Flexor Brevis Minimi Digiti, . *ib.*
Interoſſei, ... *ib.*
Internal, . . . 325
External, ... *ib.*
Aponeuroſis Plantaris, . . *ib.*
Chemical Analyſis of the Muſcles, . 326
Joints, ... 329
General Structure of the Joints, . *ib.*
Modifications of the Cellular Subſtance, 330
Joints of the Head and Back, . . 333
Joint of the Lower Jaw, . . 334
Joints of the Ribs, . . . 335
Joints of the Upper Extremity, . 336
Shoulder Joint, . . . 337
Elbow Joint, . . . 338
Wriſt Joint, . . . 339
Finger Joints, . . . 340
Joints of the Lower Extremity, . . 342
Thigh Joint, . . . *ib.*
Knee Joint, . . . 344
Fibula, ... 349
Ankle Joint, . . . *ib.*

- Arrangement of Joints, . . . *Page* 353
- Burſæ Mucoſæ, . . . 355
  - Seat of them, . . . 356
  - General Structure and Uſe of them, . 357
- Chemical Analyſis of the Joints, . 358
- Vaſcular Syſtem, . . . 359
  - Heart, ... *ib.*
  - General Office of it, . . 360
  - Particular Deſcription of it, . . *ib.*
  - Circulation of the Heart, . . 365
  - Situation of it, . . . 366
- Pericardium, . . . 367
- Subſtance of the Heart, . . 369
- Cauſes of Circulation, . . . 370
- Valves of the Heart, . . . 372
- Chemical Analyſis of the Heart, . . 373
- Anatomical Preparation of the Heart, . *ib.*
  - Dry Preparation, . . . *ib.*
  - Corroded Preparation, . . 374
- Principal Organs concerned in the Circulation, 375
- Lungs, ... *ib.*
- Action of the Lungs, . . . 378
- Chemical Analyſis of the Functions of the Lungs, 383
- Anatomical Preparation of the Lungs, . 385
- Membranes of the Thorax, . . 386
  - Pleura, ... *ib.*

Mediaſtinum, . . *Page* 387

Review of the Action of the Heart, . 389

Blood, and its Compoſition, . . 390

Red Globules, . . . 391

Gluten, ... *ib.*

Seroſity, ... 392

Changes on the Blood in its Circulation, . 393

Oxydation, ... *ib.*

Increaſed Stimulus, . . . 394

Generation of Heat, . . . *ib.*

Cauſes of theſe Changes, . . 395

Fœtal Circulation, . . . 396

Peculiarity of the Oxydation of its Blood, . 398

Chemical Analyſis of the Blood, . . 400

Vaſcular Diſtribution of the Thorax. . 403

Bronchial Arteries, . . . 404

Æſophageal Arteries, . . 406

Intercoſtal Arteries, . . *ib.*

Internal Parts of the Abdomen, . 409

Peritonæum, . . . *ib.*

Diviſion of the Abdominal Organs, . 411

Stomach, ... 412

Chemical Analyſis of the Gaſtric Fluid, . 417

Inteſtines, and their Diviſion, . . 418

Small Inteſtines, . . . 419

Duodenum, . . . *ib.*

Jejunum, . . . 420

Ilium, ... 421

Great Inteſtines, . . . 422

Cæcum, . . . *Page* 423
Colon, ... *ib.*
Rectum, ... 424
Appendage of the Inteſtines, . . 425
Meſentery, ... 426
Meſentery proper, . . . *ib.*
Meſocolon, . . . *ib.*
Meſorectum, . . . 427
Omentum, . . . 428
Omentum of the Stomach, . . *ib.*
of the Liver, . . 429
of the Colon, . . *ib.*
Vaſcular Diſtribution of the Stomach and Inteſtines, . . . 431
Arteriæ Phrenicæ, . . 432
Arteria Cœliaca, . . . 433
Coronaria Ventriculi, . . *ib.*
Superior, . . 434
Arteriæ Meſentericæ, . . 435
Superior, ... *ib.*
Colica Media, . . . 436
Colica Dextra, . . . *ib.*
Ilio-Colica, . . . *ib.*
Inferior, ... 438
Arteriæ Hemorrhoidales, . . 439
General Review of the Structure, Action, and relative Uſes of the different Chylopoetic Viſcera, or Stomach and Inteſtines, . *ib.*

GENERAL HISTORY

OF

ANATOMY.

I.

THE Science of Anatomy, like moſt others of importance to ſociety, claims a remote antiquity. The common accidents of life, the buſineſs of war, and the ſlaughtering of different animals as food, would naturally afford opportunities of obſervation on their form and ſtructure which would lay ſome foundation for this branch of ſtudy.— But ſuch caſual obſervation cannot be conſidered as any regular commencement of the ſcience. This can be dated properly no higher than the age of Hippocrates, who disjoining medicine and its auxiliary branches from philoſophy, gives us the knowledge of Anatomy as far as it had then gone.

In proſecuting the Hiſtory of Anatomy, therefore, it is to be only traced as a ſcience from this æra, and diſtinguiſhing its different periods by particular *diſcoveries* or improvements, they may be arranged into ten diviſions.

II.

The *firſt* diviſion, or æra, extends from the time of Hippocrates to that of Ariſtotle. The knowledge of Anatomy at the firſt part of this period, ſeems to have been chiefly drawn from the diſſection of animals; neither does any diſtinction ſeem to have been made between the arteries and veins, and between the nerves and tendons. At its concluſion, however, the diſtinction between the firſt ſeems to have been known, an attention paid to the ſtate of the pulſe, and the knowledge of the ſubject even aſſiſted by the uſe of delineations or *drawings*.

III.

The 2*d* æra reaches from the time of Ariſtotle to the diſcoveries of *Hierophilus* and Eraſiſtratus. During this period conſiderable improvements appear to have been made in Anatomy in conſequence of the ſtudy of it by the Alexandrine Academicians, and the encouragement of the Egyptian Princes, who were frequently preſent at their diſſections. At the concluſion of this æra, ſome knowledge of the *Lacteals* ſeems to have prevailed, and the proper name and office of the

Nerves was aſſigned. Accurate deſcriptions alſo of the principal organs occur, and even of ſome of their minute parts.

IV.

The 3*d* æra includes the ſtate of Roman knowledge in Anatomy; but nothing here appears new, or aims at diſcovery, till the time of Galen. By this author the ſtate of Anatomical Science was accurately detailed as far as it then went, and was wrought up into a ſyſtem with much plauſible phiſiological diſquiſition: a work which continued the Code of Medicine for no leſs than 12 ſucceeding centuries.

V.

The 4*th* æra comprehends that long and dark period, from the overthrow of the Roman empire to the revival of learning in Europe. During this lengthened period, which reaches from the age of Galen to the riſe of Veſalius, no improvement in Anatomy can be traced. The religion of the Arabians was a bar to diſſection, and conſequently to the progreſs of this ſcience, while the Weſtern nations were ſo much ſunk in barbariſm as to be incapable of proſecuting any particular ſtudy. At the concluſion, however, of this æra, ſome traces of the diſcovery of the *Lymphatics* appear, and the gravid uterus and ovum ſeem to have been rudely examined.

VI.

The *5th* æra commences with the labours of Veſalius, who, laying aſide in a great meaſure the knowledge of former times, as delivered by Galen, truſted to his own diſſections in his account of the human ſtructure; and his account he alſo aſſiſts by *delineations* or *plates*, which for their beauty and accuracy are ſtill admired. He is the firſt author that gives their proper names to the muſcles. His improvements were followed by Fallopius and Euſtachius, who gave likewiſe plates, and who at the ſame time made ſome leſſer diſcoveries in the minute parts of the human ſtructure.

VII.

The *6th* æra forms a period of leſs importance than the former, extending from the time of Veſalius to that of Dr. Harvey.—During this time the general deſcription of the body was well underſtood. It was the phyſiology or knowledge of the economy that continued in a lame ſtate. The attention, however, to the ſtudy of Anatomy was now general in Europe; and the termination of this period was diſtinguiſhed by the important diſcovery of the circulation.

VIII.

The *7th* æra, beginning with the knowlege of the circulation of the blood, was alſo diſtinguiſhed by what may be termed the proper diſcovery of the *Lacteals*, formerly hinted at by *Hierophilus*—the firſt was the work of Dr. Harvey, whoſe reaſoning and concluſions ſoon gained ground, and after ſome oppoſition in favour of the knowledge of the Antients, from whom he was conſidered by ſome to have wreſted his diſcovery, his opinions gave a new turn to the practice of medicine. The ſecond, or the diſcovery of the *Lacteals*, was reſerved for Aſcellius, who thus traced the progreſs of the nouriſhment into the ſyſtem as Harvey had previouſly done it in its perfect or elaborated ſtate by the circulation.

IX.

The 8*th* æra is diſtinguiſhed by various improvements in the arts of preparing the body for examination, and by different accurate deſcriptions of the human ſtructure, correſponding with Dr. Harvey's ideas. Diſcoveries were alſo made during this time of ſeveral minute parts belonging to particular organs; and the concluſion of this æra was marked by another important diſcovery, that of the Valvular Lymphatics by Bartholine and Rudbec.

X.

The 9*th* æra is remarkable for the labours of Malpyghi and Ruyſch, to illuſtrate the diſcoveries of preceding authors, and to detect the ſtructure of the minute parts of the body by injection, and by other modes of preparation, and alſo by a compariſon of the human ſtructure with that of animals, or what is termed *Comparative Anatomy.* This æra terminates alſo with the attempt of Lower, founded on the diſcovery of the circulation to cure diſeaſes by the art of *tranſfuſion.*

XI.

The 10*th* æra commences with the inſtitution of the different learned ſocieties throughout Europe, when a ſpirit of experiment and inveſtigation ſhewed itſelf every where alive. But in anatomy leſs now remained to be done. The leading principles of this ſcience were ſufficiently known, and it remained for the moderns chiefly to improve by accuracy and fullneſs of deſcription, by elegance of delineation, and neatneſs of preparation, the ſubjects already treated and brought forward.—In Morbid Anatomy, or the illuſtration of diſeaſe, they have indeed been more conſpicuous than in any other part. The ſtructure of the gravid uterus has alſo received much new light from the inveſtigation and plates of Dr. Hunter, and the Valoular Lymphatic ſyſtem has been detailed with preciſion, and its proper offices aſcertained and eſtabliſhed by the labours of Hunter, Monro, and others.

XII.

In rating the merit of different countries in the relative progreſs made by them in this ſcience, the Dutch and Italians certainly deſerve the preference in reſpect to their inveſtigation of the ſtructure of Man; while the Britiſh and French, particularly the former, have ſtudied more the explanation of its œconomy; by ingenious experiments, have endeavoured to throw light upon it; and to apply what is known to the ſucceſs of practice.

INTRODUCTION.

I.

AS the office of a phyſician conſiſts in removing diſeaſe, a previous knowledge of the ſtructure of the parts in which it is ſeated, becomes indiſpenſibly requiſite.

II.

This knowledge is attained by Anatomy, or the art of opening the body, so as to diſcover the ſituation, form, connexion, and properties of its ſeveral organs; and from a change in theſe, more or leſs apparent, conſtituting diſeaſe, a diviſion of Anatomy comes to be formed into two parts, that of the *Sound* and that of the *Morbid* ſtate; the latter being properly illuſtrated by a compariſon with the former.

III.

The body, whatever the particular ſtate or condition it diſplays, we find always a compoſition of matter variouſly arranged, and aſſuming either a ſolid or fluid appearance. A general view, therefore, of this arrangement, forming a ſyſtem or whole, on the proper connexion of which both its exiſtence and œconomy depend; is a neceſſary introduction previous to unfolding its diviſion into parts, or noting the different appearances and compoſition of the latter.

IV.

General View of the Animal Structure.

Every animal, beſides thoſe ſigns of exiſtence diſplayed by the vegetable kingdom, is diſtinguiſhed more or leſs by a *certain unſeen* and *voluntary impulſe* or inclination ariſing from its ſenſibility; which, though unconnected with the matter of which it is formed, conſtitutes the principle of its *action*.

V.

Action in the animal is requiſite for the poſſeſſion of life, and it may be properly ſaid to conſiſt in *motion*. By this action, the parts ſubjected to its influence, are experiencing a conſtant change in the particles of their compoſition; and by this change they are expoſed to unavoidable decay.—To prevent ſuch decay taking place, or ſupply that unavoidable waſte, the conſequence of action, *certain powers* are aſſigned to particular organs of the body, named thoſe of *ſenſe*, by which a judgment is formed of ſuch ſubſtances as poſſeſs a capability of being aſſimilated or converted into animal matter.

VI.

As all ſubſtances do not poſſeſs this capability, a ſelection of them becomes eſſential; and in order to make this ſelection, a change of ſituation is required.—Hence the animal muſt poſſeſs the faculty of tranſporting its body from one direction to another. To do this, ſome baſis is neceſſary, or part ſtronger than the reſt, to form a ſupport to the latter. This part is diſtinguiſhed in the body by the appellation of *bone*, the compoſition of which, to avoid unneceſſary weight, and at the ſame time to preſerve an equal breadth of ſurface for the connexion of the ſofter parts, is internally of a concave ſtructure.

VII.

That motion may be permitted by means of this baſis or ſupport which the ſyſtem receives from bone, certain diviſions in the latter become neceſſary, and theſe diviſions are differently made, according to the extent of motion that is required. Thus,

1ſt. When a bone is divided into two, and the extremities of it are intended for motion, that this motion may be permitted at the place of their junction, a ſofter ſubſtance is interpoſed under the name of cartilage, to prevent an exceſs of friction, and increaſe their agility.

2*d*. But where this motion is demanded in a leſs degree, or might even prove fatal by affecting the ſituation of ſome principal organ; inſtead of this ſubſtance being merely interſpoſed, the bones as in thoſe of the breaſt and back, are firmly joined by a greater quantity of it.

3*d*. Where this motion is required to a much greater extent than the ſimple addition of cartilage permits, which is a firm ſubſtance without any cavity; the bones become alſo ſurrounded by a ſtrong kind of membrane which contains within it a liquor for lubricating the cavity or joint it forms, named ligament.

VIII.

By this variety of ſtructure, are the bones or baſis of the body fitted for motion; but in order to its taking place, they muſt be connected with certain ſubſtances of a leſs ſolid nature, which poſſeſs the power of contraction.

Theſe ſubſtances are termed *muſcles*. They are compoſed of fibres of a ſoft ſucculent texture, exceedingly numerous to afford them ſufficient ſtrength.

IX.

By the contraction of the muſcles, one bone more moveable, becomes drawn towards another leſs ſo; and in order to effect it, the extremity of the muſcle falls to be inſerted near the joint of the former bone, where the motion of it is moſt freely permitted. But from the quantity of fibres of which a muſcle is compoſed, the breadth of ſurface at this part would be deficient for their inſertion: hence their number is concentrated into a more ſolid ſubſtance, named *tendon*. In certain parts alſo, even the ſubſtance of the muſcle, though concentrated into tendon, would not admit a ſufficient contraction for the degree of motion required; as in the fingers and toes, where a number of joints intervene. Beſides, therefore, the muſcle being converted into tendon, it becomes neceſſary, in order to increaſe its effect, to tie it down at different places by a ſort of ligature or ſheath, directed acroſs it.

X.

Thus by the connexion of the muſcles to the bones is motion permitted; and it is made by ſecuring one part of the body, in order to give freedom of action to another. The conſequence of motion is the procuring of aliment, which is firſt divided by the hands, then applied in ſufficient portions to the mouth, where, from the exertion of the jaws it is ſeparated more minutely into pieces by the teeth, and when ſufficiently comminuted, it is puſhed down by the muſcular power of the tongue and throat into its proper receptacle of the ſtomach.

XI.

The *ſtomach* is ſeated in the belly, and is a chief mark of diſtinction between the animal and vegetable ſtructure. It conſiſts of a muſcular part, with certain coats for containing the aliment. From its termination is continued a long gut named the *inteſtinal canal.* Into it the food deſcending, is by its muſcular exertions puſhed downwards till, reaching its extremity, the feculent portion comes to be diſcharged.

XII.

Hence, of thoſe ſubſtances introduced by the ſtomach as convertible into animal matter, part only is received into the conſtitution; and, previous to this taking place, it undergoes in its deſcent into the ſtomach, and alſo in this organ, a certain change, by mixing with a variety of liquors, the general property of which, is, to approximate it nearer and nearer to the animal compoſition. On its paſſing from the ſtomach into the inteſtinal canal, it becomes there abſorbed by a number of veſſels pervading its ſurface, and extending to the meſentery. Their ſize increaſes as they proceed, and they join at laſt into one duct which riſes along the ſpine, named the *thoracic duct;* and it terminates at the ſubclavian and jugular veins. At this termination, the liquor named *chyle*, or what is ſeparated from the food by means of the inteſtinal veſſels or lacteals, is received into the maſs of blood. By the maſs of blood it is diſtributed through the body, and thus nouriſhment is diſtributed to every part. For this purpoſe the blood poſſeſſes a conſtant ſtate of motion, or has paſſages by which it is conveyed to the different parts of the ſyſtem.

XIII.

On examining the nature of the blood, it conconſiſts of four diſtinct parts:

1ſt. A quantity of air eaſily detached on expoſure, which exhales in the form of a thin vapour.

2d. A red part named the globules, which affords colour to the whole, and is compoſed of a number of round particles, compared in their form to a ſhilling or a thin cheeſe, being the heavieſt part of the maſs.

3d. An aquous liquor, with a proportion of ſalt of a particular kind, differing both from the vegetable and foſil alkali, and this part is termed properly the ſeroſity.

4th. . A tough part or gluten named alſo the coagulable lymph, appearing moſt abundant in inflamatory diſeaſes.

Theſe parts on veneſection are diſcovered in the following order:

1ſt. The internal air contained in the blood flies off.

2*d*. By the admiſſion of the external atmoſphere, the gluten or lymph is coagulated.

3*d*. The red globules by their weight fall to the bottom, or come to be intangled by the gluten.

4*th*. The ſeroſity is ſeen to ſeparate.

XIV.

In reſpect to the uſes of theſe parts, the ſeroſity preſerves the fluidity of the whole maſs; and likewiſe the figure of the red globules. By the gluten it acquires a body, and any exudation of the former into the different cavities, is prevented from taking place. To the red part is owing the momentum of the blood, and its difficulty of paſſing to the extreme veſſels.

XV.

This fluid as eſſential to the ſupport of the body, is abundantly diſtributed through its ſeveral organs. It begins from the *heart*, a large muſcular organ ſituated in the ſuperior part of the body, of a conical figure. To its ſuperior part on one ſide is attached a large veſſel, named the *vena cava* ſuperior, to diſtinguiſh it from that named the inferior, by which the blood is returned from the inferior parts. Where theſe again meet, a large ſac is placed, or part projecting, like the external ear of an animal, named the *auricle*. Below this, another cavity of a ſimilar nature is diſcovered, termed the *ventricle;* and, as the veins are furniſhed with valves, by which the blood when advanced is prevented from returning, once received into the *auricle*, it is there compreſſed by the action of its muſcular fibres; and, an opening taking place between the auricle and ventricle, it is by this compreſſion next determined into the ventricle. This opening being covered with a valve, named the *tricuſpis*, like the veins, it yields only in one direction; hence, when the ſame action in the ventricle is exerted from the incapacity of the blood returning to its former ſituation, it is next inclined to a large veſſel termed artery, which divides into two branches. Theſe branches advance into the lungs, are there ſeparated into minute portions, and after circulating the blood through theſe organs, they return it again by correſponding veins which unite into one trunk, that terminates on the other ſide of the heart, in a ſac or auricle ſimilar to the former. In like manner, below this ſac, there is a ventricle from which the blood is puſhed into a paſſage that forms the beginning of a conſiderable veſſel, named the *aorta*. As the aorta makes an arch at its origin, from this place of it branches are derived to the head and arms, while its chief trunk goes downwards, and by ſeparating into a number of ſmall veſſels, which at laſt anaſtomoſe and become too minute for obſervation, it communicates the circulation to the inferior parts. The extremities of thoſe veſſels again being furniſhed with correſponding veins, the fluids they tranſmit are returned through theſe veins, by their junction in the *cava* to the heart.

XVI.

From this view the heart poſſeſſes two ſides, a right and left, both ſimilar in their appearance. Through it the blood circulates twice, for it is returned to it before undergoing the general circulation, after being either in ſome manner rectified, or receiving an additional quality, as chemiſtry has attempted to ſhew, by its diſtribution in the lungs.

XVII.

To perform the circulation, then four parts are required:

1*ſt.* A vein by which the contents of the thoracic duct with the refluent blood, is conveyed to the heart.

2*d.* An auricle in the latter to which the vein is united, which becoming diſtended by its fluid, is made to contract, or is forced into action.

3*d.* A ventricle, which in conſequence of this action of the auricle receives its contents, and from them receives, when accumulated, a ſimilar impulſe. And,

4*th.* An artery by which this accumulation of the ventricle is diſcharged, and tranſmitted to the different parts of the body.

XVIII.

In this tranſmiſſion, the mode and time in which theſe parts ſeverally act, merits conſideration.—For the auricle and ventricle alternate with each other, and the artery again agrees in the time of its action with the auricle; while the diſtribution of the fluid through it, is effected by the impulſe of the ventricle driving into its trunk a greater quantity of blood than it is capable of containing. This occaſions its ſwelling out at that part to which the blood is firſt directed, and from the reſiſtance of its coats to this extenſion their contraction is excited, which forces an alteration in its contents, and hence it communicates a ſtroke to the finger when applied. The ſame alſo takes place in ſucceſſion through its whole extent; yet at its extremity this contraction becomes rather weaker, by reaſon of its diſtance from the heart, whoſe power is here inſufficient for its excitement. When the blood therefore comes at laſt to the vein, it moves in a more inſenſible and uniform manner, without any alternate ſtop, as occurs in the artery.

XIX.

The uſe of this general circulation of the blood, beſides conveying nouriſhment to the ſeveral parts of the ſyſtem, and preventing the coagulation of the maſs of fluids; tends alſo to unload it of thoſe parts, which in conſequence of putrefaction or ſome other morbid change, are rendered unfit for being longer detained in the body: for thus, by its conſtant motion, they are expoſed to the different outlets, and perhaps too ſome farther alteration in the chyle, beſides being merely converted into blood takes place.

XX:

Thus the circulating maſs we have found compoſed of different parts; and as the arteries and veins divide into minute branches, it is natural to ſuppoſe ſome of them become ſo exeeedingly minute as to admit only certain parts of it. Of theſe veſſels named *lymphatics*, there are ſeveral kinds.

1ſt. Thoſe which, though ſtill connected with the general circulation, admit only the ſerum or its ſerioſity.

2d. Thoſe which, unconected with the general circulation, ſecrete from it certain parts for the nouriſhment of particular organs as the joints, the eye, the bowels, &c. named ſecerning.

3d. Thoſe which take up from the cavities to which they are conveyed, the fluids ſecreted by the ſecerning veſſels, named therefore abſorbents, and terminating in the colourleſs veins.

XXI.

But beſides theſe veſſels which circulate only the blood, or particular parts of it, we find this fluid in certain ſituations of the body entirely altered in its nature by other veſſels of a more complex texture, connected together in a convoluted manner, under the appellation of *Glands*. The manner in which theſe act to affect this change, is unknown; and from each a paſſage leads for the diſcharge of their ſecretion, termed the *Excretory Duct*. Their uſe, however, ſeems important to the ſyſtem. By ſecretion, the ſeveral motions of the joints is allowed. In the ſame manner the hurtful or uſeleſs parts of our maſs of fluids is expelled; and, by an arterious ſeparation, nutrition itſelf is performed, and the ſpecies of animals preſerved.

XXII.

To a ſimilar operation, the action of the mind, perhaps, or the power of thought, may be aſcribed. It depends on the *brain*, which is evidently a glandular ſubſtance, in which the principle of impreſſion reſides, and by which it is communicated. The *brain* is of a white colour, divided by anatomiſts into two portions; the upper named the *cerebrum*. the under the *cerebellum*; and from theſe certain cords of the ſame appearance are produced. The principal of theſe cords deſcends, covered by the back-bone, named the *ſpinal marrow*; others paſs from the bones of the head, and each ſeparating into different portions, the latter are diſtributed over the ſeveral parts of the ſyſtem, by which ſenſe and motion are allowed. Where they take their origin, they are covered by certain membranes, to which the names of *Dura* and *Piamater* are applied; and as they are of a ſoft pulpy texture, theſe membranes ſerve to defend them from being injured by the compreſſion of the other parts.

XXIII.

In this manner is the animal ſtructure completed; and over the different parts of it deſcribed the ſkin is thrown, being connected to the muſcles by means of an intervening ſubſtance, named *cellular*. By the ſenſibility of the ſkin, danger comes to be avoided; and from its porous nature, what is hurtful to the body is allowed to be diſcharged.

XXIV.

Thus, from the view of its conſtituent principles, the body ſeems naturally divided into two parts, a ſolid and fluid, the latter depending for its action on the former, and both requiring to be jointly conſidered. This is commonly done under two general heads, diſtinguiſhed by the names of Oſteology and Splanchology. Laying aſide this common arrangement, we ſhall proſecute the ſubject more properly under three diviſions:

1. *Simple Demonſtration*, conſiſting in the examination of the bones or hard parts, which is commonly preferred in their dried ſtate.

2. Diſſection and Demonſtration, where the ſofter parts are firſt unfolded by the knife before they become the ſubjects of inveſtigation. And,

3. Morbid Anatomy, or a view of the changes produced by diſeaſe, where, in addition to the former means, the farther arts of injection and preparation are required.

Part I. *Demonſtration of the Hard Parts, or Oſteology.*

XXV.

Oſteology, or the hiſtory of the bones, is that diviſion which conſiders thoſe parts of the ſtructure that ſerve for the ſupport, defence, and attachment of the reſt, conſtituting, as formerly obſerved, its baſis. From the other parts they differ, by poſſeſſing in their compoſition a greater quantity of earthy matter, which proportionally increaſes their ſtability; hence, when burned for a conſiderable time, they loſe but a third part of their weight, conſiſting of that portion of oleaginous matter intended for lubricating their texture, and increaſing its nouriſhment. Thus they are the moſt permanent and indeſtructible parts of the animal ſtructure, and they continue the memorial of it when all the other parts are annihilated.

XXVI.

Every animal ſolid conſiſts of a fibrous ſtructure; and though in the bones this is more compacted than in the ſoft parts, yet by means of heat and other methods of maceration, variouſly employed, they can be made to ſeparate into different layers or lamin when this fibrous texture is apparent. Theſe laminæ, however, and their arrangement, is moſt viſible in the extremities of ſome bones, where alſo the cavernous ſtructure is moſt conſpicuous, intended for the reception of a certain quantity of marrow, which by entering into the compoſition of bones, and beſtowing on them a degree of pliancy, add to their power of reſiſting any force directed againſt them. Hence, in old people, where it is defective, their rigidity renders them more liable to fracture, or this accident takes place from ſlighter cauſes than in young ſubjects.

XXVII.

The marrow is contained in a membrane proper to itſelf. This is called the *internal perioſteum*, for the external ſurface of all bones is covered in like manner by a membrane named the *external perioſteum*. This membrane is connected to them by a number of threads, many of which are blood-veſſels entering into the bones, and by that means carrying on their circulation. Perhaps at firſt they were all ſo, though gradually as ſolidity advances, they loſe their primary uſe. This membrane of the bone is looſely connected to the neighbouring parts by a ſubſtance reſembling cotton, termed the cellular membrane; only the fibres of it are compacted into layers, and when drawn out, this membrane by its elaſticity, is brought back to its proper place. It paſſes alſo from one articulation to another, over the intervening ſubſtance.

XXVIII.

Formation of Bone.

The formation of bone has much divided the opinions of Anatomiſts, and the peculiarity of its ſtructure to external appearance has made them loſe ſight of that reaſoning, which is applied to the growth of other parts.

The *1ſt* opinion referred this proceſs to a *coagulable exudation* proceeding from the bone, and hardening by exſiccation into the ſame ſubſtance, after paſſing through the ſeveral degrees of conſiſtency, from a fluid to a ſolid ſtate. This opinion was afterwards modified by one author, who conſidered the exudation as *pure blood*, which on being effuſed, acquired all the after changes neceſſary to give it the proper color and hardneſs of bone.

XXIX.

The 2*d* opinion, and a more plauſible one was that which attributed the formation of bone to a ſecretion from its external membrane or the perioſteum, founded on the ſuppoſed analogy between the bark and wood of a tree; and this opinion was attempted to be ſupported by a variety of experiments from the thickening and inflammation of this part in caſes of fracture, and from the adheſion it always acquires to the bone at the ſeat of the injury.

XXX.

The 3*d* opinion conſidered its growth as depending on the action of the internal veſſels of the bone itſelf, and this opinion was ſupported by the firſt appearances of the bone, which ſo ſoon as conſiſtent, diſplays a vaſcular ſtructure, and that before any connection is formed with the perioſteum.

XXXI.

But, regarding all theſe opinions as proceeding from imperfect obſervation, the formation and growth of bone is to be viewed as a proceſs that requires the concurring action of every part. That its depoſition is in a particular manner aſſigned to the arteries, and that this depoſition is made under various circumſtances, according to the particular form or conſtruction of the part.

Wherever, therefore, bone is to be formed, an increaſed arterial circulation appears, and this circulation appears always firſt in the centre of the jelly, cartilage, or exudation, where the bone is to be formed. In the ſame manner as the oſſification advances, the arterial depoſition withdraws; and, the red color which is firſt conſpicuous, diminiſhes from the centre towards the extremity of the part.

XXXII.

Thus, in tracing the hiſtory of oſſification, the firſt mark that appears is an artery running in the centre of the bed where the bone is to be formed, which is ſucceeded by others that form as it were a plexus of veſſels from which a point of oſſification begins and gradually extends, varying its color from the different ſhades, till it acquire the whiteneſs, conſiſtence, and qualities of bone. Oſſification, therefore, is a proceſs in itſelf no way dependant on any intermediate texture for promoting or accelerating its growth, and totally unconnected with cartilage any farther than as it forms occaſionally a bed for its depoſition, which is equally formed by membrane or parts of a ſofter texture.

XXXIII.

From this view, the color of a bone in a certain degree determines the progreſs of its oſſification. An incipient redneſs ſhews the commencement of the proceſs, and this becomes gradually obſcured. In long bones, the oſſification proceeds in a number of circles or central points, and as theſe circles oſſify, the redneſs removes from the centre or middle towards the extremities. Thus the arteries or veſſels are loſt gradually in their own depoſition or ſecretion.

XXXIV.

Hence, vaſcular action is the cauſe of every change in the animal ſtructure, and the foundation of this change is communicated by the blood, which even acquires its elaborated or perfect ſtate by the ſame means. To animalize whatever it receives, is the peculiar property of the ſyſtem, and in doing it to appropriate this matter to the particular purpoſes required, the body is alſo furniſhed with different and varied powers of ſecretion. The ſecretion of earthy or bony matter in the fœtal ſtate hardly takes place. Cartilage here forms a temporary ſupply for bone, and this cartilage is afterwards gradually removed as the bony ſecretion is introduced in its place. Even in this introduction, the original form or ſtructure of the part is preſerved and extended by the very ſame powers which ſupply the ſecretion. The ſame means alſo which thus form and mature the bone, preſerve it alſo in health. A conſtant depoſition and a conſtant removal of its parts takes place in a degree ſuited to what is neceſſary to continue its ſtructure and conſiſtence for performing the various offices of life.

XXXV.

But bone is expoſed to injury as well as the ſofter parts. Under this injury it is liable to take on various degrees of morbid action, and its ſecretion comes either to be impeded, or the abſorption of its earth too much accelerated. Hence various degrees of brittleneſs and ſoftneſs occur. Its proportion of earth forms the peculiar characteriſtic of bone, and the connecting medium of this earth, depends on a quantity of mucus. For the proper depoſition of this earth, a ſufficient action of the veſſels is required; hence an interruption by motion of the part prevents a firm callus in caſes of fracture from being formed, and a renewed excited ſtimulus, and even a diviſion of the part is neceſſary before a complete firm growth can afterwards take place. Thus the action of the abſorbents and of the depoſiting arteries bear a mutual proportion to the irritation applied.

XXXVI.

The period of renovation and change in caſes of bone, forms a curious ſubject of inveſtigation. This has been particularly aſcertained by the uſe of coloring ſubſtances, by which, in the ſpace of 24 hours, the bones can all be tinged, and this color can be removed or ſupplied at all times with almoſt equal rapidity. From this fact, a proof is formed that the veſſels of the bones are equally active as thoſe of the ſoft parts. Nay, caſes occur, where, by the ſtrong or too active exertion of their abſorbents, the bones are partially removed, and even the whole of the bony ſyſtem has been reduced to an almoſt gelatinous ſtate.

Nor are the bones leſs endued with ſenſibility than the other parts. This is particularly ſhewn by the preſence of inflammation, when pain far exceeding that of the ſoft parts, is produced in them.

XXXVII.

From theſe facts, the vitality and organic nature of bone is ſufficiently clear. It varies in the rapidity of its growth at different periods of life, and it is alſo interrupted by occaſional circumſtances of diſeaſe. Thus health and vigor forward its operations, and debility and diſeaſe arreſt its progreſs. In general, it is completed about the 20th year; and though thus, on the whole apparently ſlow, yet certain parts are quicker than others, according to the neceſſity nature ſeems to require for the completion of their growth.

XXXVIII.

The facility of oſſification may be conſidered as depending on three circumſtances:

1. The ſoftneſs of the bed or nucleus, in which the bone is formed.

2. The ſize of the veſſels that depoſite the bony ſecretion; and

3. The number of points in which oſſification commences.

XXXIX.

Diviſion of Bones.

After theſe few remarks on the formation of bone, it is proper to conſider next its diviſion.—This has been made by Anatomiſts into three different claſſes:

1. The *1ſt* claſs includes thoſe bones of a broad flat appearance.

2. The *2d* claſs comprehends thoſe which are long and round; and

3. The *3d* takes in thoſe irregular ones not reducible to the former two claſſes.

XL.

Connection of Bones.

From the variety of ſtructure in the bones, ſince they all require to be connected in order to anſwer their ſeveral uſes, different methods of effecting this become neceſſary, regulated by the degree of motion they are deſtined to execute: for,

1. Where no motion is intended, the indentation of the ragged edges of two ſeparate pieces, forms

a connection termed a ſuture. This chiefly prevails in the bones of the head.

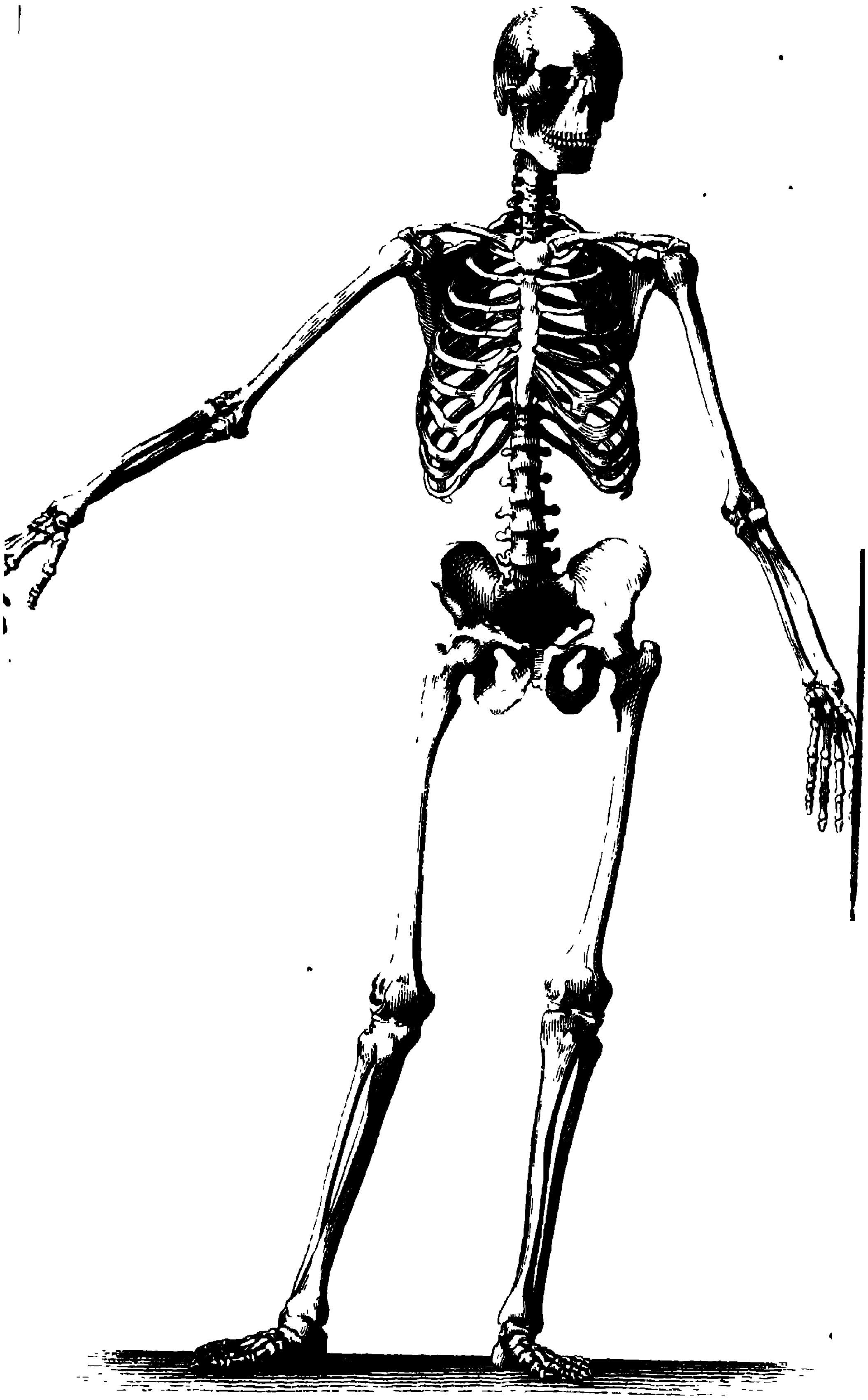
2. Where motion but only limited is deſigned, which the former indentation would prevent, a ſubſtance of a leſs ſolid nature, poſſeſſing a degree of elaſticity is made to intervene and to form a junction under the name of cartilage. This connection chiefly appears in the different parts of the cheſt or thorax.

3. Where, on the contrary, no reſtriction to motion is intended, the extremities of the bones, inſtead of the former junction, are incloſed in a ſtill ſofter ſubſtance, named ligament. They are alſo tipt with cartilage to increaſe the facility of their play, and within this ligament certain bodies are ſituated which excrete a liquor to preſerve theſe parts conſtantly in a moiſtened ſtate.

XLI.

Dried Bones, or the Skeleton.

From theſe modes of connection, eſpecially from the firſt, the ſkeleton poſſeſſes a more numerous diviſion of the parts of its ſtructure than could be ſuppoſed from appearance. Their number is alſo increaſed according to the age of the ſubject, for oſſification being in general ſlow, it begins in the ſame bone as formerly obſerved in ſeveral points; which, before uniting in the adult into one compact piece, renders every bone diviſible into certain portions, and theſe portions are known by the



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general name of Epiphyſis, when ſituated at the extremity of the bone; though, after puberty, when from the increaſe of oſſification their fibres unite ſo as to prevent any ſuſpicion of their former ſeparation, they are termed apophyſes or proceſſes.

XLII.

In taking a general view of the ſkeleton, one is ſtruck with the particular direction and ſituation of its ſeveral parts with regard to each other. Inſtead of its general pillar being placed perpendicular, it makes a number of turns, and reſembles in its ſhape an Italic *S*. Hence, though in every ſituation the whole weight may be thrown on the common baſis, or fall between the feet, yet a number of muſcles are neceſſary to give ſupport, and any one poſition ſoon tires, while to counterbalance this apparent inconvenience, by this ſtructure a greater variety of motion is permitted.

XLIII.

In deſcribing the ſtructure of the body, Anatomiſts have commonly divided it into three parts, the *head*, *trunk*, and *extremities*. This diviſion we ſhall adopt as beſt calculated for a clear and regular elucidation of the whole.

XLIV.

Bony Part of the Head, or Skull.

The moſt important part of Oſteology is the ſkull, being that part which ſerves for the defence of the brain, and which, of courſe, contains the organs of ſenſe, and thoſe powers which influence the reſt of the ſyſtem. The demonſtration of it therefore requires to be accurate and minute, which is treated under two diviſions, the Cranium, or Brain Caſe, and the Face.

XLV.

Brain Caſe, or Cranium.

Appearance.—The Cranium very much reſembles an egg with the ſmall end turned forwards. This ſhape it ſeems evidently to take from that of the internal organ it covers, as being the mould on which its oſſification is extended. Such a ſhape is certainly the beſt adapted to this part. It is capacious, reſiſts accidents, and is convenient on various occaſions, by offering a leſs ſurface of reſiſtance from the flatneſs of its ſides. Thus the ear is leſs expoſed by it to injury, and the circle of viſion is alſo conſiderably increaſed. In the various nations of Europe, however, the head appears to aſſume ſome ſlight variety of form; but this is more the effect of artificial compreſſion than the moulding of nature.—Diſeaſe alſo has at times the ſame influence, but not in a great degree.

XLVI.*

Structure.—In dividing the Cranium by a horizontal ſection, the ſtructure of its bones becomes conſpicuous, which conſiſts of two tables and an intermediate diploe, ſimilar to the cancelli of other bones. Of theſe tables or plates, the external is conſidered as thicker and more ſpongy than the internal. Conſequently it is liable to injury, while the internal plate being more ſubjected to preſſure, is denſer and thinner, and has received the appellation of the Tabula Vitrea, or Glaſſy Table. Theſe tables are only parted by an inconſiderable ſpace, which is filled up with the diploe. The diploe is a ſort of membranous texture, covered with veſſels whoſe office is to ſupply marrow and to nouriſh the bone, and which communicates with both the internal and external membrane of the ſkull.

XLVII.

This texture of the Cranium is in general very irregular, and therefore there is by no means the danger commonly imagined of committing miſtakes in the progreſs of operations here. In the uſe of the trepan, the appearance of blood always marks the cutting of the diploe, and the future ſteps of perforation require the moſt guarded caution. In children the ſkull conſiſts properly of one table; in youth, though completely formed, the thickneſs of its tables is leſs certain; and in old age it declines towards the ſtate of childhood, or acquires a gradual thinneſs.—Pits and hollows from the impreſſion of veſſels, form alſo as life advances in different parts of the ſkull, which alter its thickneſs; and which being uncertain in their ſituation, require an operator to proceed with a guarded hand.

XLVIII.

General Diviſion of the Skull.

This general ſtructure of the Cranium, when minutely examined, is compoſed of eight diſtinct parts:

1. The upper and fore part of the head is formed by the frontal bone, which extends a little to the temples, and gives the upper part to the ſocket of the eye.

2. The ſides and upper parts of the head are compoſed of the parietal bones, which, by their name, are conſidered as the walls or ſides of the ſkull.

3. The back part of the head and top of the neck is formed by the occipital bone.

4. The lower parts of the ſides of the ſkull are incloſed by the temporal bones, which, from the change of their hair with age, gives their name as marking the progreſs of time.

5. The fore part of the baſis of the ſkull is formed by the æthmoid bone, which, ſituated over the noſe, is principally connected with the organ of ſmell.

6. The back part of the baſe of the ſkull is made up by the ſphenoid bone, which lies over the throat, forming the back of the noſtrils and roof of the mouth.

XLIX.

Sutures.

Theſe ſeveral parts deſcribed are joined together by certain ſeams or indentations, named Sutures.

1. The firſt of theſe is the coronal ſuture, by which the frontal and parietal bones are joined. The extent of this ſuture is acroſs the head from ear to ear, in one direction; and deſcending behind the eye, it enters the deep part of the temple, and changing its appearance, it becomes ſquamous inſtead of ſerrated. Its name is derived from the crown of flowers, or garlands, anciently worn on this part.

2. The ſecond joining, or ſuture, is what has been termed the *Lambdoidal.* Its ſituation is behind the one ear; it then aſcends and paſſes over the occiput like an arch, and it terminates by deſcending behind the other ear. From its form it reſembles the Greek letter (Λ), from which it derives it name.

3. The top of the head is interſected by the third ſurute, named the Sagittal, which extends between the two former ſutures; and from this ſituation, as it reſembles an arrow between the

ſtring and the bow, it has been diſtinguiſhed by this title.—A continuation of this ſuture takes place, at times, to the very noſe.

4. The temporal ſuture, which connect theſe bones with the parietal, occipital, and frontal, forms the next joining to be noticed. This ſuture makes an arch nearly equal with that of the external ear, it then connects itſelf with the coronal and lambdoidal ſutures, and it has been diſtinguiſhed by the name of the Squamous or Scaly Suture.

5. The ſphenoid and æthmoid bones, at their articulations, poſſeſs ſutures which are irregular, and correſpond to the ſingularity of their ſhape.

6. Another joining to be noticed, is the *Tranſverſe Suture.* It runs acroſs the face, and joins the latter to the bones of the ſkull, by ſinking down into the orbits. It is a ſuture equally irregular as the former.

7. The laſt joining is that which connects part of the temporal bone to the cheek, and which, from forming an arch or yoke, has been termed the Zagomatic Suture. It is of ſmall extent, and has the ſerrated edge only on one point.

L.

Theſe ſeveral ſutures have been commonly divided, by Anatomiſts, into two kinds, the *true* and *falſe* ſutures; the former are diſtinguiſhed by their ſerrated appearance on the outſide of the ſkull, which appearance they loſe within. Theſe ſutures are three in number, viz. the Coronal, the Lambdoidal, and Sagittal. The latter, or falſe ſutures, are the temporal and tranſverſe ſutures, which have more of the ſquamous than ſerrated appearance at the edge. To theſe ſutures may added two additional ones, which are at times conſpicuous; the one termed oſſa triquetra, placed between the occipital and temporal bones, forming an addition to the lambdoidal ſuture; the other, placed between the parietal and temporal bones, forming an addition to the ſquamous ſuture.

LI.

A knowledge of theſe different diviſions of the ſkull is of the firſt importance to a Surgeon in forming a judgment where injuries of the head occur. Real ſutures are not always to be diſtinguiſhed by their ſerrated edge; neither does a fracture of the ſkull always run in a direct line, ſo as to diſtinguiſh it from a ſuture. The moſt experienced will often be deceived in theſe caſes, which points out at leaſt the neceſſity for ſtudying this part of Anatomy with much attention. It is alſo the more neceſſary, as the appearance of the ſutures deſcribed is not always regular, and a conſiderable variety prevails in different individuals.

LII.

To underſtand the ſubject properly, it is uſeful to trace here the manner and progreſs of oſſification. The ſkull is originally in a ſoft and griſtly ſtate, conſiſting of an infinite number of pieces connected with the circumſtances of its growth. The bones oſſify from their centre to their circumference, by which they are more concentrated, or cloſer at their middle, and are more ſcattered and diverge at their extremities. As the oppoſite extremities of the bones meet, their ſcattered fibres grow into the interſtices of each other, and thus in time, as oſſification becomes bounded, the ſuture with its ſerrated edge comes to be produced.—In childhood the bones of the head are all connected by membranous expanſions; the ſutures are hardly yet beginning to cloſe.—The ſubſtance of the bone is not diviſible into its proper plates, and every part wears the appearance of imperfection, compared with the adult.

LIII.

In every ſtage of life, certain of the ſutures are always conſpicuous, however the reſt may occaſionally vary. Theſe are, the ſagittal ſuture in the middle of the parietal bones, the coronal over the forehead, the lambdoidal behind, and the ſquamous formed of the lower edges of the ſame bones. In the ſituation of theſe, therefore, no error can at any time take place.

LIV.

The particular conſtruction of the ſkull, and the manner of its growth, has been conſidered as attended with ſundry advantages.

1. As accelerating the growth by the more numerous points of its oſſification.

2. As cauſing its ſpherical figure to be more exactly formed.

3. As occaſioning a more equal thickneſs of its parts.

4. As yielding by its diviſions to the growth of the brain.

5. As accommodating itſelf to preſſure in delivery.

6. As limiting the extent of fractures where injuries occur.

7. As admitting a dilatation when acted upon internally by diſeaſe.

8. As allowing a drain to take place more readily from the internal parts by the ſutures.

LV.

But many of theſe advantages have been overrated, and though they may take place to a certain degree, yet phyſicians have frequently built too much on this ſlight foundation, in purſuing certain modes of practice with reſpect to the formation of iſſues or drains, and alſo in forming an opinion with reſpect to the extent of fracture.

LVI.

Having examined the general diviſions of the ſkull, and its ſeveral connecting points or ſutures, we now proceed with the particular detail of its ſeparate pieces.

Frontal Bone (*Os Frontis*).

General Deſcription.—The firſt of theſe is the frontal bone, compared in its ſhape to a clam-ſhell, from its internal hollowneſs and equal thickneſs. This hollow of the bone internally is divided equally into two by means of a ſpine or prominent line, the origin of the membranous partition dividing and ſupporting the hemiſpheres of the brain. Externally the ridges the ſeat of the eye-brows are its moſt conſpicuous part, and alſo the two prominences, below which are ſituated the ſinuſes of this bone. Its chief irregularity lies in the orbitary plates, or that part of it which forms a ſocket for the eye and a ſupport to the lower part of the brain, and into the open ſpace of which is inſerted a principal ſhare of the æthmoid bone.

Particular Detail.—In delineating its parts, the 1*ſt* to be noticed is the *Superciliary Ridges*, on which are placed the eye-brows, being an arched line correſponding in length to them, through which the different arteries paſs to the bone, producing a ſtrong adheſion of the teguments at this part. Here alſo, the frontal muſcles ariſe, and among other holes for the tranſmiſſion of veſſels, one, in particular, paſſing obliquely through, termed the Superciliary Hole, deſerves to be remarked. Through this hole proceeds a ſmall artery from the orbit, which mounts over the forehead. As it paſſes the ridge, it is termed the Superciliary Artery, and when higher up, the Frontal Artery. By it a communication is eſtabliſhed between the internal circulation of the eye and the external veſſels of the forehead and temples. It is alſo joined by and carries along with it a ſmall nerve, termed the Superciliary nerve. The termination of this Superciliary ridge is in the two proceſſes which, from forming the angles of the eye, have received the title of *Angular*. And theſe proceſſes are divided into the internal and external angles of the eye. Betwixt the internal angular proceſs, is ſituated a ſharp projecting point, exactly in the middle of the bone, named the *naſal point*. This point is rough and irregular, at its root ſo as to give a firm ſeat to the naſal bones. At the end of the ſuperciliary ridge ſtands a riſing or *bump*, the ſeat of the *frontal ſinuſes*, though it is ſometimes wanting. The *frontal ſinuſes* are two in number, ſituated above the root of the noſe, one at each ſide, and the two tables of the ſkull recede at this part to form them. Their hollow is of various depth, according to the age and other circumſtances in the conſtitution of the individual, for in the child they are entirely wanting. Each ſinus is ſeparated by a partition, though ſtill there is a communication by a ſmall hole; at times, however, both the partition and hole have been found wanting; but the communication with the noſe always prevails, and it is by means of this communication, that the organ of ſound is rendered more ſonorous. The cavity of theſe parts is lined by a thin and ſenſible membrane, the ſame that is continued over the noſe and throat. It poſſeſſes a ſecretion from its ſurface, which preſerves it in a moiſtened ſtate, and which, by the antients, was conſidered as drawing ſomething noxious from the head.

LVII.

The ſituation of the ſinuſes ſhould be particularly attended to and declined in the application of the trepan, unleſs it is impoſſible to raiſe a fracture in an eaſier way. The ſinuſes are alſo the ſeat of a particular accident, viz. the generation of inſects, but this we ſhall have occaſion to treat under the head of Morbid Anatomy.

LVIII.

On the internal ſurface of the frontal bone, the moſt conſpicuous part is the *ſpine* or *ridge* to which the falx is connected, or that dividing membrane, which runs through the middle of the head and ſupports the brain. The prominence of this part varies in different individuals, and alſo, according to age. It is greateſt at its root, and leſſens in its progreſs up the forehead, ending at times in a groove. In this groove is lodged the great longitudinal ſinus, which obſerves the courſe of the falx attached to the ſpine. At the root of the ſpine is a ſmall blind hole, at which the inſertion of the falx commences.

The next part of the bone internally, that claims attention, is the *orbitary proceſs.* This proceſs covers the eye on each ſide, departing from the general direction of the bone, and ſtanding inwards. By the conſtant action of the eye, and the preſſure of the brain, its plate is rendered thin and tranſparent. The former ſmooths its ſurface below, and the latter impreſſes it with frequent convolutions above.—Hence, from the thinneſs of this part, accidents here are frequently fatal, and eaſily penetrate the brain. Upon this orbitary plate two depreſſions fall to be notieed in the ſocket of each eye; the one is ſmall and deeper at the inner corner, being the ſeat of a ſmall cartilaginous pully for the tendon of one of the muſcles of the eye; the other a pretty large diffuſed hollow for receiving the lacrymal gland, or that gland which ſecretes the tears and gives moiſture to the eye.

LIX.

At firſt the frontal bone is compoſed of two pieces, which diviſion often remains in the adult, particularly in females; and by this diviſion the ſagittal future comes to be continued to the noſe. When the two pieces unite together, their edges are turned inwards as meeting with leaſt reſiſtance.

LX.

Parietal Bones (*Oſſa Parietalia*).

The parietal bones compoſe a very large part of the ſkull, and are therefore moſt ſubject from their ſituation to injury, which is here much eaſier removed in caſes of fracture by the trepan. This bone alſo is pretty uniform in its thickneſs, though marked internally with a number of depreſſions from the ſinus, and the circulation of the membranes of the brain.

Particular Detail.—In their figure the parietal bones are ſquare, they are united together by deep ſerrated edges, and in the ſame manner to the occipital and frontal bones. The corners of both bones are obtuſe. One of theſe corners however runs out to a great length, and has been named the Spinous proceſs of theſe bones. On their lower edge they are concave, and of a ſemi-circular form where they join the temporal bones, the edge of which overlaps the edge of the parietal, and forms by its thin ſcale the ſquamous ſuture. A little above this ſuture is a white ſemicircular line, which marks the origin of the temporal muſcle. Where the two bones unite and form the ſagittal ſuture, a groove is conſpicuous, equal in ſize to the finger, and fitted to contain the longitudinal ſinus. Its ſize is moſt apparent on fitting the two bones to each other. The great artery of the dura mater traverſes this bone at different parts, and in various directions, and is ſo buried in the lower corner of it, that the trepan could not applied without wounding it.

In the parietal bone there is but one hole through which a ſmall vein and artery paſs to the ſinus and falx.

LXI.

Two circumſtances require to be noticed in the parietal bones. The firſt is their connexion with the frontal, which is ſomewhat curious, for the upper part of the os frontis is ſupported on their arch; but as, at the ſides, the parietal is more in danger of being compreſſed, the parietal now paſſes over the frontal; and at this part the frontal is remakably ſtrong, ſo that this part of the head has every advantage that can be given it for reſiſting preſſure.

The ſecond circumſtance is the ſtate of theſe bones at birth, at which period there is a want of bone where the two pieces of frontal bone in the adult join with the parietal ones, and the oſſification here extends in a very gradual manner, ſor children are generally two years of age before the oſſification is compleated. On laying the hand on this part, alſo a conſiderable motion is felt from the pulſation of the veſſels, which has occaſioned it to be named the Fons Pulſatilis, or Bregma.

LXII.

Occipital Bone (*os Occipitis*).

The occipital bone is the thickeſt of the cranial bones, but varies conſiderably in its degree of thickneſs in different parts. Into it are inſerted the chief muſcles of the head and neck, it gives ſupport to the brain, it contains the cerebellum, and tranſmits from its opening its prolongation, or the ſpinal marrow.

Particular Detail.—By the impreſſion of the muſcles this bone is particularly marked on its external ſurface; and the firſt of theſe impreſſions running acroſs, is termed the Tranſverſe Spine; below which, another is alſo conſpicuous, making it double. The interſtice between theſe impreſſions makes a prominent ridge, which croſſing the former ridges, is termed the crucial ſpine; and this part of their croſſing being prominent, is named the Poſterior Tuberoſity.

Internally the bone diſplays a ſimilar ſurface, making one tranſverſe line of regular ſmooth crucial ridges. To the great internal ridge is attached the tranſverſe partition, which divides the brain from the cerebellum, and known by the name of the *tentorium cerebello ſuper-extenſum.* In the corner or angle where this membrane is ſixed, lies the great ſinus, which dividing here to right and left, is named the lateral ſinuſes; and in its continuation downwards to the neck, they form the *jugular veins.* Where the longitudinal ſinus divides into the lateral, a triangular groove is formed, which follows the courſe of the ridges. The tranverſe ridge alſo is ſurrounded with four ſmooth hollows, the two uppermoſt of which contain the backmoſt lobes of the brain, and the two under ones contain the cerebellum, being thus interſected by the tentorium.

LXIII.

The proceſſes of the occipital bone are three in number. The firſt, lying in the very baſe of the ſkull, and joining the occipital to the ſphenoidal bone, from its ſhape reſembling a wedge, is named the cuneiform proceſs.

The two others, which are buttons, ſtanding off from the foramen magnum, flattened and of an oval form, termed condyles, prevent the head from turning or rolling, but allow its motion backwards and forwards.

LXIV.

The holes of this bone are the laſt part to be noticed. The principal one is the foramen magnum, which tranſmits the continuation of the brain or ſpinal marrow. Its edges are ſmooth, thicker at the lip, and firm behind in order to give a firm attachment to the ligament of the ſpine. Through this hole paſſes alſo the vertebral vein, and by it are returned the vertebral arteries and the ſpinal acceſſory nerve.

The 2*d* hole, placed at the root of either condyle, is ſometimes double, and tranſmits the great lingual nerve.

The 3*d* hole, exactly behind the condyle, is ſometimes wanting. It gives paſſage to the cervical vein of the neck to enter the great lateral ſinus; and when wanting, this vein paſſes by the occipital hole.

LXV.

In the fœtus, the occipital bone is divided into four pieces, the firſt reaches from the middle of the lambdoidal ſuture to the foramen magnum; the 2*d* and 3*d* are placed at the ſides of that foramen, and the 4*th* forms the cuneiform proceſs. It has been alſo ſuppoſed that the ſagittal ſuture is ſometimes continued to the foramen magnum, as well as to the noſe; but there is nothing in the formation of the bone to countenance it. In the operation of the trepan it is laid down as a rule, that this bone ought to be avoided on account of the continuation of the longitudinal ſinus, as alſo of the lateral ones: but caſes may occur where the ſurgeon is to balance between the danger that attends the performing the operation, and the neglect of it, as where the bone is beat in upon the brain: but ſhould the depreſſion happen to be ſituated between the ridge which ſerves as the boundary between the ſmooth part of this bone and the lambdoidal ſuture, there is no danger; and if an extravaſation happens, this is one of the beſt places for making an opening, the blood or matter falling by its weight upon the membranes that divide the brain and cerebellum. It is even poſſible to raiſe a piece of depreſſed bone lower than the lateral ſinuſes, within the ridge formed by the muſcles. There is alſo a poſſibility that the ſkull may be fractured here without having received a blow: if a perſon fall with violence, eſpecially an old perſon, the condyles may be puſhed upwards, of which there are inſtances.

LXVI.

Temporal Bones (Oſſa Temporum).

The temporal bones are very irregular in their thickneſs, in their depreſſions, and in their different points. They originally conſiſt of two pieces, diſtinguiſhed by the names of the pars petroſa, and pars ſquamoſa. The former is hard and irregular, triangular in its ſhape, and juts inwards towards the baſe of the ſkull, and by containing the organ of hearing which renders it unequal, it is the medium or depoſitory of all the nerves which are connected with the ear. The latter thin and ſcaly, riſes over the lower part of the parietal bone, and is ſmoothed by the action of the temporal muſcle. It is grooved alſo to form the ſquamous future, and is exceedingly thin on its fringed edge.

A third portion of the temporal bone, thick, hard, and divided into cells, forms caverns for the reverberation of ſound; and this part is termed its occipital angle. It is connected with the other bones by the additamentum futuræ ſquamoſæ.

LXVII.

The firſt proceſs of the temporal bone is the zygomatic, which, with a proceſs of the cheek bone, marked by an intervening future, forms the yoke or arch of the temple, under which the temporal muſcle paſſes to the lower jaw. It is broad and flat at its origin, and gradually diminiſhes as it approaches the cheek bone. From the upper edge alſo of this arch is ſtretched to the parietal bone a firm tendinous covering over the temporal muſcle; and from this place alſo ſeveral muſcles ariſe which belong to the face, particularly the maſſeter and zygomaticus, the one moving the jaw, the other drawing the angle of the mouth.

The 2*d* proceſs is the Styloid, ſo named from its reſemblance to the antient pen. It continues long even in the adult in a cartilaginous ſtate, and it is only firmly oſſified in age, when its length at times exceeds two inches. Its ſituation is behind the jaw, ſtanding obliquely out from the head, and giving origin to a ligament which ſupports the os hyoides, and to ſeveral muſcles which belong to the throat and jaws. Theſe muſcles are all named from this proceſs, and from the part to which they belong; and from their ſituation their action is directed to pull upwards and backwards.

A ſmall riſing or ridge of the bone has received the name of the Vaginal proceſs. It is however properly the root of the Styloid proceſs, though it has been noticed as a ſeparate one.

The 3*d* proceſs of the temporal bone is the the Maſtoid or Mammillary, projecting from under the ear; eaſily diſtinguiſhed by the external feel, and reſembling ſomewhat the point of the thumb. By this proceſs, which is internally hollow, the tympanum or outer cavity of the ear is enlarged. Under its root is attached the dygaſtric muſcle, and the point of this proceſs gives origin to the maſtoid muſcle before, and behind to ſeveral others that take all this general title along with their particular appellations.

The *4th* proceſs forms the outer margin of the hole of the ear, and is named the auditory proceſs. It is a ſmall arch of bone, rough and irregular in its edge. Upon it is extended the membrane, or what is termed the drum of the ear. Till adoleſcence, it is a diſtinct ring laid upon the reſt of the bone; but after that period it is found firmly united to it. As well as the extenſion of the drum upon it, the cartilaginous tube of the ear is alſo affixed to it, for it extends from the root of the mammillary proceſs to that of the zygomatic.

LXVIII.

The holes of the temporal bone are numerous and important, and they are either connected with the organ of hearing, or with the circulation to the brain.

1. Of the former, the *1ſt* is the external opening of the ear or meatus auditorius externus, covered with its membrane, which communicates that motion from the air neceſſary to the action of the internal organs.

2. The internal opening of the ear, or meatus auditorius internus, is a large hole ſituated upon the back of the triangular pars petroſa. At firſt it is a ſmooth regular circle with a rounded lip, perforated internally with ſeveral ſmall holes; by

means of which the auditory nerve, or rather the portio mollis of it, is diſtributed and expanded over all the cavities of the ear, ſo as to form the true organ of hearing.

3. A ſmall pin-like hole appears on the fore-part of the petrous bone, which receives a ſmall nerve of the 5th pair, that enters the ear, and joins the portio dura of the auditory nerve.

4. Before the maſtoid and behind the ſtyloid proceſs, is the hole that gives paſſage to the portio dura to the cheek, and hence it is named ſtylo-maſtoid hole.

5. The laſt and moſt important opening of this bone, is that for the euſtachian tube, or the paſſage through the throat to the ear. (*Iter a palato ad aurem.*) The whole of this paſſage is irregular, broken, and ragged. The tube itſelf appended to it, is entirely cartilaginous. Its form is that of a trumpet, long and winding; wide at its entrance to the throat, and gradually contracting as it advances to the ear. It is the ſtate of this tube that occaſions an alteration of the voice and hearing under a cold; and it is alſo the impreſſion on it which occaſions a crackling ſound on ſhutting the mouth and blowing the noſe. This part gradually falls off with the ſoft parts, and is wanting in the ſkeleton.

Of the holes tranſmitting the circulation to the brain.

1. The *1ſt* is that which, ſituated at the root of the ſtyloid proceſs, and near the point of the petrous bone, gives entrance to the carotid artery, the principal one of the head which paſſes through the bone in the form of an Italic *S*; and for which the opening is fitted by making inſtead of a hole, a ſhort crooked ſmooth canal for this purpoſe. By this mode of entrance to the head, the impetuoſity of the circulation is probably retarded, an opinion confirmed by analogy.

2. The *2d* opening is for the tranſmiſſion of the great lateral ſinus to the neck, where it aſſumes the form of the internal jugular vein, and this opening which is large and lacerated, is compoſed equally by the temporal and occipital bones. Sometimes it is divided into two, one tranſmitting the veſſel, the other the eight pair of nerves in their paſſage to the ſtomach.

3. In the occipital angle of the temporal bone, there is alſo a ſmall hole for the paſſage of a vein into the great ſinus, or an artery to the dura mater.

LXIX.

In the fœtus, beſides the diviſion of this bone formerly noticed, there is no appearance of maſtoid or ſtyloid proceſs; and inſtead of a meatus externus, there is only a ring of bone, in which the membrana tympani is fixed.

It has been laid down as a rule, that the trepan ſhould never be applied to the temporal bone, but this opinion ſeems improperly founded on the idea of the injury to the tendons which cover it producing fatal irritation. Fractures may occur here in ſeveral ways, the bone may be forced inwards, a fiſſure from the top of the head may extend downwards, where the cauſe is violent, from the parietal bone through the ſuture, or by force applied to the top of the head, the lower part of the parietal bone may ſtand outwards and break the ſcale of the temporal bone.

LXX.

Ethmoid Bone (*Os Ethmoides*).

The ethmoid is a light ſpongy bone, convoluted ſo as to reſemble a honey-comb, and perforated with an infinity of holes for receiving and diſtributing the organ of ſmell, which has cauſed it to be termed the cribriform or ſeive-like bone. It is incloſed between the orbitary proceſſes of the frontal bone. One horizontal plate gives opening to the olfactory nerves, which are received upon it through a number of perforations, and other plates again receive in their courſe thoſe nerves, and expand them ſo as to form the organ of ſmell. By the convolutions of theſe plates, the ſurface of this ſenſe is extended, and the parts of the ethmoid bone performing it, are termed its ſpongy bones. In the orbit of the eye there is one flat plate of this bone, which is ſmooth from the rolling motion of the eye, and is therefore named the os planum. Thus in its different parts the ethmoid bone ſupports the brain, compriſes in part the ſocket of the eye, and forms entirely the organ of ſmell. But its principal diviſion is its cribriform plate, to which the olfactory nerves adhere, and lying upon it, they ſhoot down their roots through its perforations as already noticed.

LXXI.

The proceſſes of this plate to be diſtinguiſhed are:

1. The criſta galli, a ſmall perpendicular projection, ſo termed from its reſemblance to a cock's comb. It divides the plate into two, by riſing directly in its middle, and it gives attachment to the falx of the dura mater. On each ſide of it is placed an olfactory nerve, on the forepart of its root there is a notch; which contributes in part to the formation of the blind hole *(foramen cæcum)* of the parietal bone.

2. Oppoſite to the criſta galli, ſtands out in the ſame perpendicular direction the naſal plate, or commencement of that partition which divides the two noſtrils. It conſiſts of a thin firm proceſs of ſolid bone, inclining a little to one ſide: it is united with the vomer, and the latter again

with the cartilage, on the fore or project of the noſe. the

3. From either ſide of the ſeptum or partition, depends a ſpongy, or, as it is termed, turbinated bone, covered with a delicate membrane, on which the olfactory nerves are expanded on leaving the cribriform plate of the ethmoid bone, and by the convolutions of this bone, the powers of ſmell are extended. Theſe convolutions take place in a much greater degree in other animals of acute ſmell, than in the human ſubject. With theſe convolutions, the ſpongy bones diſplay alſo a number of cells, by which the effluvia drawn up, are detained longer in the organ.

4. On the inner ſide of either eye lies the orbitary plate of the ethmoid bone, firm, ſmooth, and poliſhed, and in ſhape a regular ſquare, reſembling when in its place a ſeparate bone, and termed the os planum.

5. In the inner corner of the orbit, juſt over the noſe, is placed another part of the ethmoid bone, termed from its thin ſcaly appearance and ſhape, the os unguis. In this part is ſituated the groove which holds the lacrymal ſac, and conducts it into the noſe. Its perforation therefore takes place in thoſe caſes where the paſſage has become obſtructed.

6. Along with thoſe parts, the cells of the ethmoid bone are not to be omitted. They are

ngly numerous in its ſpongy ſubſtance, bone nged into rows, divided by partitions, and the os planum and the os ſpongioſum have each their ſeparate cells. Theſe cells are 12 in number, though they ſometimes vary.

In the fœtus the ethmoid bone is divided into two by a cartilaginous partition, which afterwards forms the naſal plate and the criſta galli.

LXXII.

Sphenoid Bone (*Os Sphenoides*).

The ſphenoid is the moſt irregular ſhaped bone in the body, and has therefore been compared to a wedge, to the figure of a bat, &c. It lies in the very baſis of the ſkull, and cloſes the cranium below, being connected to all the other bones of the cranium by its ſuture. Through this bone is tranſmitted almoſt all the nerves of the brain, and its body therefore is trifling, compared with the importance it derives from its numerous openings.

LXXIII.

1. The 1*ſt* of its proceſſes are what are termed its temporal ones, or wings, from lying in the hollow of the temple, and by their junction with the frontal, parietal, and temporal bones, they have a ſhare in forming the ſquamous ſuture.

2. The 2*d* proceſs of this bone is the orbitary, where its wing forms the outſide of the orbit of

the eye. Its ſituation is exactly oppoſite to the os planum, with a regular ſmooth ſurface.

3. The 3*d*. proceſs is the ſpinous, and conſiſts of a narrow point at the back part of the bone, which ſinks under the petrous portion of the temporal bone. Through a ſmall hole in it alſo, the great artery of the dura mater enters.

4. The 4*th* proceſs is the ſtyloid, projecting like a ſmall peak within the condyle of the lower jaw from the baſis of the ſkull, and giving riſe to a muſcle of the palate.

5. The next proceſs is the pterygoid, which in the figure of the bone compared to a bat, repreſent its feet, and are, properly, four in number, two external, and two internal. Each of the former is thin, flat, broad, and hollow without, where the external pterygoid muſcle has its origin. The latter is narrower and longer, has its end tipt with a ſmall hook, and with its fellow forms the back part of the noſe. Between the two proceſſes, the euſtachian tube comes down in a wide groove, and opens behind the internal proceſs, or behind the noſtril, and over the back of the palate. The hook of this proceſs, or backmoſt point of the palate, is termed the hook of the palate, over which the circumflex muſcle of the palate moves, turning with a ſmall tendon round it. The great muſcles of the lower jaw ariſe like-

wiſe from the pterygoid proceſſes, and take their names from this origin.

6. The azygos, or ſingle proceſs of this bone, projects from under its middle and forepart. It ſtands over the centre of the noſe, and gives a firm attachment to the vomer or bone of partition, which with the united azygous proceſs of the ethmoid bone, forms the upper and back parts of the ſeptum.

7. The clynoid, the next proceſſes are four in number. They conſiſt of four little knobs, ſo termed from their ſuppoſed reſemblance to bed-poſts. The two anterior ones terminate each in a ſharp point projecting backwards. The two poſterior ones, are ſituated tranſverſely, ſomeway behind the anterior proceſſes, riſing with a broad and flat proceſs, which divides into two knobs, and inclining obliquely forwards towards the former proceſſes.

The ſpace incloſed by theſe four proceſſes, is named the turkiſh ſaddle, or ſella-turcica ephippium. It lodges the pituitary gland, whoſe uſe is unknown. On each ſide of this part alſo, the carotid arteries riſe, and mark a groove in it by their circulation. The optic nerve alſo lies in a groove at the forepart, betwixt the two anterior proceſſes. Some few alterations take place in theſe parts on ſome ſkulls, by a connection of the anterior and poſterior clynoid proceſſes in one.

This bone is alſo diſtinguiſhed by poſſeſſing an irregular cellular texture in different parts. Theſe cells no doubt perform the ſame office as the cells of the former or the ethmoid bone.

LXXIV.

The holes of the ſphenoid bone are even more numerous than its proceſſes.

1. The firſt are the optic holes, which are large, round, and tranſmit the optic nerve through a groove in each, and along with the nerve the ocular artery alſo paſſes in a twiſting manner round the nerve.

2. The next hole is a wide ſlit, termed the foramen lacerum, under the anterior clynoid proceſs. It extends outwards, ſharp, and flat; it is wide near the ſella turcica, and turns gradually narrow as it approaches the temple, where it ends in a ſlit. Through this part the third, fourth, and the firſt part of the fifth, and ſixth pair of nerves, and the ocular vein paſs. Theſe nerves are all connected with the organ of ſight, and are therefore appendages to the optic in their offices.

3. The 3*d* opening is the round hole, or foramen rotundum, named from its ſhape, and placed a little behind the foramen lacerum. Through it is tranſmitted the ſecond part of the fifth pair of nerves, which goes to be diſtributed on the upper jaw.

4. The foramen ovale is an oval hole, farther back and more external than the former, or about $\frac{1}{2}$ inch behind it. It gives paſſage to the third branch of the fifth pair of nerves, and alſo to the veins which accompany the principal artery of the dura mater.

5. The ſpinous hole, or foramen ſpinale, the next in order, and in the very point of the ſpinous proceſs, is a ſmall round opening immediately behind the former. Through it is tranſmitted a ſmall artery, the principal one of the dura mater, and which makes an impreſſion on the parietal bone.

6. The laſt opening is the pterygoid hole or foramen pterygoideum. This hole differs from the reſt in not giving exit to a nerve or veſſel, but in returning into the head a reflected branch of the ſecond part of the fifth pair of nerves. This opening is ſituated under the root of the pterygoid proceſs, is only to be ſeen in the ſeparated bones, and beſides its common name is termed alſo the Vidian hole.

7. Beſides theſe openings enumerated, ſometimes one or more ſmall paſſages are diſcovered in or near the ſella turcica, for the tranſmiſſion of blood-veſſels into the ſphenoid ſinus, or ſubſtance of the bone.

LXXV.

From this deſcription of the ſphenoid bone, it will appear to be of material conſequence to be acquainted with its ſeveral parts; for though from its ſituation it can hardly ever be the ſubject of any ſurgical operation, excepting, perhaps, in the ſingle caſe of tumours growing in the throat and back part of the noſe, many of the principal veſſels and nerves we have ſeen paſs through it, particularly thoſe which form the chief part of the noſe and eye.

In the fœtus, the temporal wings can be ſeparated from the body of the bone by maceration, and there are alſo no ſphenoid ſinus.

LXXVI.

Face.

Such is the general ſtructure of the cranium, from which we deſcend to examine the remaining part of the head or face.

The face conſiſts of a number of ſmall pieces, having one common appellation of the upper jaw. Theſe pieces have been divided into ſix on each ſide, and this diviſion is a conſequence of their manner of oſſification, having begun in a number of points, and in the end occaſioning diviſions between them, as they proceed to an ultimate progreſs.

LXXVII.

Bones of the Noſe (*Oſſa Naſi*).

The firſt of theſe diviſions is what is termed the oſſa naſi, which are two bones outward and convex, and by their junction forming a ſtrong arch. They are thin condenſed plates, without any intervening cancelli. Their flat rough edge is laid upon the ſimilar edge of the frontal bone. The naſal proceſs of the upper jaw bone incloſes them in a particular way, ſo as to prevent their being forced in, and their rough lower edge gives a firm attachment to the cartilaginous parts of the noſe; the junction of which with the bone, forms the prominent point termed its bridge, often the ſeat of luxation from injury.

The connexion of this bone to its fellow, is by the anterior naſal ſuture.

LXXVIII.

Nail Bone (*Os Unguis*).

The next diviſion, or os unguis, was formerly noticed as a part of the ethmoid bone, but anatomiſts have generally conſidered it as a ſeparate part, and agreeable to that idea it may be deſcribed as a flat bone, the thinneſt and moſt brittle of any in the body, named from its ſize and ſhape, as reſembling the nail. Its ſituation is the inner and forepart of the orbit or angle of the eye, and contiguous to the top of the noſe. Its ſurface is hollowed by a large groove for lodging the lacrymal ſac and duct. On the part of the bone behind the groove the eye rolls, the groove occupies the end of it, and the other ſide of the groove is formed by the naſal proceſs of the jaw bone. From the delicacy of this bone it is eaſily broken, and as eaſily perforated in the operation for the fiſtula lacrymalis, the ſucceſs of which depends on keeping the perforation forward ſo as to enter the noſe. This bone is connected to the frontal bone by the tranſverſe ſuture, to the os planum by the ethmoid ſuture. Internally it is connected by the ethmoid cells.

LXXIX.

Superior Maxillary Bones (*Oſſa Maxillaria Superiora*).

The ſuperior maxillary bones follow in the order of demonſtration. They form the foundation of the face, and affect equally its ſize and ſhape. Their upper branch compoſes the ſide of the noſe. Backwards their flat expanſion forms the roof of the palate, and below their projecting circle goes to the ſockets of the teeth, or alveoli. The cavity of theſe bones internally is conſiderable. By its ſize it moulds the form of the face, and is capable of containing a pretty conſiderable portion of fluid, not leſs than an ounce.

LXXX.

Theſe bones, as well as by their internal cavity, are diſtinguiſhed alſo by their numerous proceſſes.

1. The 1*ſt* of theſe is the naſal proceſs, which riſing upwards, forms the inner part of the orbit and the ſide of the noſe. and by its outward arch, gives the noſtrils ſhape. To this proceſs the naſal cartilages are appended, and the bones of the noſe are ſupported by its ſides.

2. The 2*d* is their orbitary proceſs, or the roof of that cavity which forms the antrum maxillare, and on which the eye reſts. In this part is a groove for the ſite of the principal branch of the

upper maxillary nerve, which here from its ſituation under the eye, (for it paſſes out by the infra orbitary hole of the cheek bone,) is named the infra orbitary nerve, and in its progreſs it forms the chief nerve of the face.

3. The *3d* proceſs is that ſcabrous or unequal ragged ſurface which connects it with the cheek bone, and which, from its riſe, is named the malar proceſs.

4. The *4th* proceſs is the alveolar arch for lodging the ſockets of the upper teeth. It is thin and ſpongy, is generated with the teeth, and decays, or is abſorbed, ſoon after them. It cloſely inveſts the teeth, ſo that they are incapable of being removed from it without force, and then from its thinneſs, the alveolar proceſs is generally broken.

5. The palate proceſs is the next in order, or that which compoſes part of the roof of the mouth, and the bottom of the noſe. The middle of this part is a thin plate, which gradually becomes thick as it approaches the alveolar proceſs; and this thin plate is joined to its fellow by a broad flat ſurface, conſpicuous on their ſeparation, but binding them ſo firm, that they are with great difficulty disjoined. By this ſurface alſo a ſharp ridge or ſpine is formed towards the noſtrils, which is termed the naſal ſpine; and on this ridge the edge of the vomer is placed, ſo that it contributes to form, in ſome degree, the ſeptum of the noſe. Along theſe bones a great number of

ſmall holes are conſpicuous, which give entrance to veſſels for their nouriſhment; and the membrane of the palate is fixed to the bone by very rough tubercles and ſmall threads, which ſtill adhere even in its dried ſtate.

6. The antrum or cavity of the jaw-bone is a part of conſiderable importance, and requires a ſeparate deſcription. It is ſituated under the orbitary plate, and above the large dentes molares, ſo that the former makes its upper partition, the palate plate incloſes it below, and the cheeks are its boundary on the ſides. This cavity in its ſhape is concave to the cheek, flat towards the noſe, and divided from the noſtril by a thin plate or partition, on which the lower ſpungy bone is hung, and over it is expanded, in the recent ſubject, a membrane that leaves only a ſmall hole or two into the noſe, a ſtructure intended, no doubt, to aſſiſt more effectually the organ of ſound. The ſame lining that covers the noſtrils, extends alſo over the antrum, and forms a ſecreting ſurface for the ſeparation of mucus, which under irritation becomes morbidly changed and increaſed.

LXXXI.

From this general ſtructure and proceſſes of the maxillary bones, we come to detail their openings or holes.

1. The firſt is the *Supra orbitary hole* formerly noticed, as being under the margin of the orbit,

and giving paſſage to the ſecond part of the fifth pair of nerves, and alſo to a branch of the internal maxillary artery. Sometimes inſtead of one there are two ſmall holes.

2. The next opening is the *palate hole*, or foramen incisiorum, behind the fore-teeth, and common to both bones below, but proper to each above. This hole can receive the end of a quill. It is filled with a proceſs of the ſoft palate, and with ſmall veſſels and nerves which run between the membranes of the mouth and noſe.

3. The laſt opening, though not entirely proper to this bone, is the poſterior palate hole, formed in the back part of the palate, in the diviſion between the palate bones and the jaw bones, as the former is on the fore part of the jaw bones. It is equally large as the former, and ſerves for the tranſmiſſion of a large branch of the upper maxillary nerve, to be diſtributed on the palate.

LXXXII.

The whole ſurface of the antral part of theſe bones is every where perforated for the paſſage of veſſels and nerves to the teeth.

The connexions of theſe bones with the ſurrounding ones are numerous. To the parietal bone they are made by the tranſverſe ſuture; to the os unguis by the lacrymal ſuture; to the cheek bone by the external orbitary ſuture; to the os naſi by the lateral naſal ſuture; to the os planum by the ethmoid ſuture; and to each other by the longitudinal palate ſuture. In the fœtus there are only ſix ſockets for the teeth, there is tuberoſity, and the maxillary opening or ſinus is only beginning to form.

LXXXIII.

Cheek Bones (*Oſſa Malæ*).

The cheek bone is a large ſquare bone, ſituated in the outer part of the cheek, the external ſurface of which is convex and ſmooth, and the poſterior ſurface hollow for lodging the temporal muſcle.

LXXXIV.

This bone is divided by anatomiſts into four diſtinct proceſſes.

1. The *1ſt* is the upper orbitary proceſs, forming part of the outſide of the orbit, or outer corner of the eye and the edge of the temple.

2. The *2d* is the lower orbitary proceſs oppoſed to the former, and forming part of the lower edge of the orbit, and the edge of the cheek.

3. The *3d* is the maxillary proceſs, forming the under part of the prominence of the cheek, having a broad rough ſurface, by which it is joined to the upper bone of the jaw.

4. The *4th* is the zygomatic proceſs, forming part of the arch over the temporal muſcle, paſſing outwards and backwards for this purpoſe.

LXXXV.

To theſe parts may be joined the internal orbitar plate, forming the outer and fore part of the orbit.

No holes of importance pervade this bone but for its own circulation. It is connected to the parietal and ſphenoid bones by the tranſverſe ſuture, and to the temporal bone by the zygomatic ſuture.

LXXXVI.

Palate Bones (Oſſa Palati).

The palate bones are ſmall, and from their ſituation and uſe, would appear as an addition or lengthened ſpace to the maxillary bones for extending the ſurface of the palate, and completing the noſtrils. Their parts are numerous, and their connections uncommon.

LXXXVII.

1. The *1ſt* proceſs of theſe bones is that from which they derives their name. It is of an oblong form, and compoſes the back part of the oſſeous palate, lying horizontal with the palatal proceſs of the jaw bone. This part is thin at its middle, and turns thicker at each end. It has a rough or ragged ſurface, and where it joins its fellow, it forms the middle palate ſuture. Where it joins the

jaw bone at its palate proceſs, it makes the tranſverſe palate ſuture. From their junction the palate bones proceed backwards, ſo as to terminate in an acute point; and on each ſide of this point they make a ſemicircular line, which ends in two other points behind the molares of each ſide.

The velum palati forms a ſmall curve or arch, in the middle of which hangs the uvula or pap, and alſo its muſcle takes its origin from the ſame middle point.

2. The next proceſs of this bone is the pterigoid, or where behind the laſt grinding teeth it touches the ſame named proceſs of the ſphenoid bone, immediately before which is alſo the pterigoid, or third palate hole.

3. The naſal plate, the 3*d* proceſs, forms a portion of the ſide of the noſe, and antrum maxillare. It is thin, and riſes upwards from the palate.

4. The enlargement of the naſal proceſs into an irregular knob, as it enters the orbit, has given it the term in this ſituation of the orbitary proceſs, which is ſometimes conſidered as double. This knob is triangular in ſhape, is very ſmall, and at the ſame time deep in the ſocket.

5. The orbitary proceſs of the palate bones, from being cellular or cavernous, joins, from its ſituation and connection, the cells of the ſphe-

noid bone, and thus, by intermixing, they conſtitute but one cavity.

LXXXVIII.

Inferior Spongy Bones (*Oſſa ſpongioſa inferiora*).

The inferior ſpungy or turbinated bones are the next in the ſtructure of the face. They are diſtinct from the upper or ethmoid ones, and only ſlightly united with the upper jaw bones. Theſe bones in their figure are triangular, and ſpungy or convoluted in their appearance. They are ſituated in the lower part of the noſe, and their projection forms that point acceſſible to the finger in picking the noſe.

LXXXIX.

The proceſſes of theſe bones are two at their upper part. The anterior forms part of the lacrymal groove, and the poſterior part of the ſide of maxillary ſinus. They are covered by the ſame general lining or ſenſible membrane that pervades all thoſe parts; and on removing it, they appear hung by a ſmall hook to the edge of the antrum maxillare, with one end turned toward the opening of the noſtril, and with the other pointing backwards to the throat. They ſeem to have little ſhare in the organ of ſmell. Though the number of theſe bones is generally but two, yet a double pair is at times met with.

XC.

Theſe bones are connected to the oſſa maxillaria, oſſa palati, and oſſa unguis, by a diſtinct ſuture in young ſubjects, but in age they become firmly attached by a union of ſubſtance to theſe bones.

XCI.

Vomer.

The laſt of theſe ſmall and irregular bones, concerned in the formation of the face, is the Vomer, a thin ſlender one, dividing the two noſtrils, and named from its figure, as reſembling a ploughſhare. It is frequently bent to the one ſide, enlarging one of the noſtrils more than the other. It is compoſed of two plates, thin, compreſt and tranſparent; but ſeparated at different parts of its edge.

XCII.

The conſpicuous parts of this bone are,

1. Its baſe or upper part, where, by a wide groove, it receives the projection of the ethmoid and ſphenoid bones connecting it to the ſkull.

2. Its lower part where, by a narrow groove, it receives the rife in the middle of the palate plate, and where the palate ſuture is formed.

XCIII.

This bone is kept firm on all ſides by the ſupport of the other bones with which it is connected, and which are received into its grooves or furrows, and alſo by the general lining or covering which embraces it and all the contiguous parts.

XCIV.

To finiſh the ſtructure of the face, it remains to examine the under jaw. This conſiſts of one bone which has received various compariſons as reſembling the Greek *υ*, and as reſembling a horſe's ſhoe, or creſcent. In the upper jaw, as in the cranium, we have found a conſiderable number of bones, by which means the oſſification beginning at a conſiderable number of points, is ſooner completed, and the irregular ſhape it preſents at the ſame time formed. The riſings of the bone, alſo has the effect of protecting the orbits, enlarging the face, giving attachment to the muſcles, and ſerving other important purpoſes. In the lower jaw the ſtructure is more ſimple, but its deſcription is rendered complex by the variety of parts with which it is ſurrounded, and to which it gives attachment.

XCV.

The different parts of the jaw itſelf that deſerve enumeration, are,

1. The chin, extending between the mental holes or foramina, diſtinguiſhed, if well formed, by the ſquareneſs of its ſhape.

2. The baſe of the jaw, terminating by its ſtraight even line the outſide of the face, and reaching from the point of the chin to the corner of the jaw. Fractures of this part are known by the depreſſion or its receding from the even line.

3. The angle of the jaw is the back part of the baſe or the corner where it ends, and the bone riſes upwards to form its connection with the head.

XCVI.

The proceſſes of the jaw, equally important as theſe diviſions of it deſcribed, are,

1. The coronoid proceſs, ſo termed from its horny appearance, having its ſides flat and turned up acutely with a ſharp point. This proceſs forms the place for the inſertion of the temporal muſcle, and it is ſituated therefore behind the zygoma or arch under which the temporal muſcle runs. This muſcle embraces the coronoid proceſs on all ſides, and from the poſition of the proceſs before the articulation, an additional ſtrength is given to the action of the muſcle, while externally, from this ſtate of the ſurrounding parts, the proceſs cannot at all be felt.

2. The condyloid proceſs behind the former, is the proper articulating one of the jaw. It is like the former, flat, and ariſes from the body of the bone turned up at its angle. It has a ſmooth cartilaginous ſurface, placed upon a cervix at the upper and back

part of the bone. It is received into a long hollow of the temporal bone, juſt under the root of the zygomatic proceſs. By its exertion it acts entirely the part of a hinge, though of a peculiar kind, and admits only that degree of motion which is neceſſary in the grinding of the food.

3. The alveolar proceſſes of this jaw reſemble thoſe of the upper one. As the reſt of the body grows, they lengthen in proportion, and receive a greater number of teeth. When fully grown and expanded, their ſockets are alſo completely filled; and when their ſockets become emptied by the gradual fall of the teeth, the proceſſes that received them become abſorbed, and are carried away. The jaw then alters in ſize, becoming narrower and more prominent.

XCVII.

The holes or openings of the under jaw come next in order.

1. The *1ſt* is the great hole for admitting the lower maxillary nerve, and correſponding blood veſſels, into the hollow of the jaw, where paſſing round within its circle, the nerve gives branches to the teeth. The ſituation of this hole is the inner ſide, at the point or root where the coronoid and condyloid proceſſes part. Its paſſage is defended by a ſmall pike at its entrance, and a groove or furrow conducts downwards to the hole.

2. The 2*d* opening is the mental hole, formerly noticed on the ſide of the chin, or about an inch from its point. Through this hole the remains of the former nerve, or what part is not expended on the teeth, paſſes out on the chin.

XCVIII.

The ſurface of the lower jaw is every where remarkably hard, and within it has numerous cells. It has alſo a canal below the roots of the teeth, which communicates with the maxillary cells, at the forepart of the bone.

In the fœtus the lower jaw is compoſed of two pieces joined together in the middle of the chin by the intervention of cartilage, which gradually oſſifies, and leaves no mark of diviſion. The cavities of the teeth are alſo in the ſame ſtate as in the upper jaw. Luxation of this part is apt to happen by opening the mouth too wide, and occaſioning the condyles to ſlip forward on the zygomatic proceſs.

XCIX.

Having now examined the firſt diviſion of the body, or the head in its ſeparate and connected ſtate, deſcending downwards, we proceed to the trunk.

C.

The trunk is divided by Anatomiſts into three parts, the ſpine, pelvis, and cheſt, or thorax.

Spine.

The *1ſt* or ſpine is that column which extends from the condyles of the occipital bone, to the end of the os coccygis. Its name is derived from the projecting points of its bones, which form a continued ridge, as if but one whole. In this ridge is contained the ſpinal marrow protected from injury, while the weight of the head and other parts is at the ſame time thrown upon it, and obedient to every motion and flexion of the body, it yields readily to the weight and preſſure, to which it is thus ſubjected. Nor does this laſt interrupt the freedom of its motion, or weaken its powers of affording ſupport. Equal to every exertion required, it forms a complete defence to the delicate parts entruſted to its covering.

CI.

The ſeparate pieces of the ſpine are termed vertebræ, from their power of motion or turning. They are twenty-four in number, and the figure their united mechaniſm diſplays, differs according to the particular point of view in which it is taken. Thus when viewed anteriorly or poſteriorly, the column appears ſtraight, when again in a lateral direction, it ſeems curved; ſo as to reſemble, in ſome manner, the Italic letter *S.* Superiorly it is drawn backwards by muſcles, and formed into a curve for ſupporting the æſophagus.

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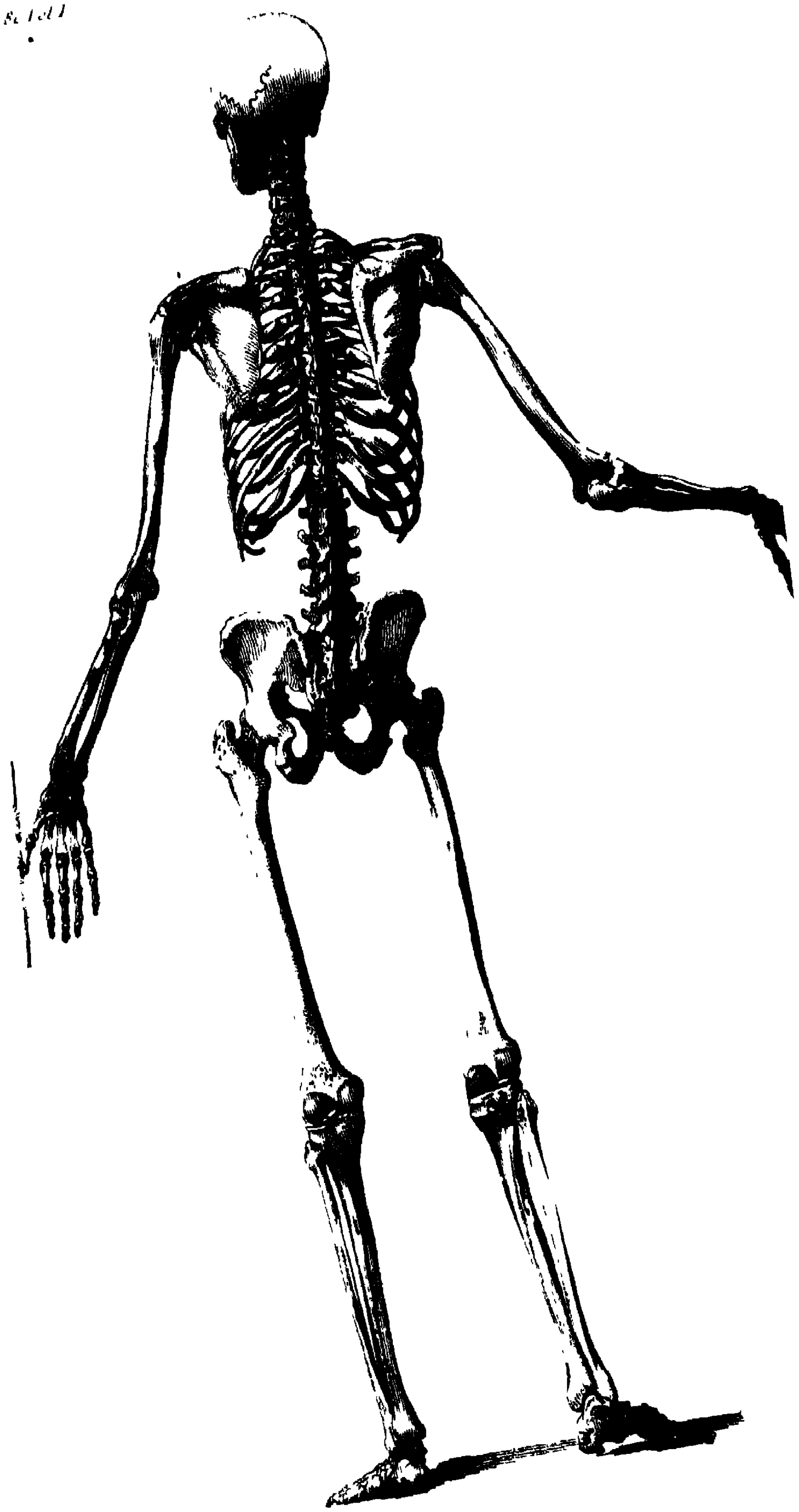

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In its middle it is alſo incurvated backwards to contain the heart and lungs; afterwards it is bent forwards to contain the abdominal viſcera; and again it goes backwards to enlarge the pelvis.

CII.

The twenty-four vertebræ of the ſpine have been arranged into three diviſions, thoſe of the neck, the back, and loins.

The *1ſt* are ſeven in number, free and looſe in their motions, ſimpler than the reſt in their ſtructure, and with little or no projecting points.

The *2d* are twelve in number. They are big and ſtrong, each locked into its fellow by their proceſſes being laid over each other. They are likewiſe ſteadied by their junction with the ribs, which conſiderably limits their motion.

The *3d* are five in number; the largeſt and ſtrongeſt of the whole, and ſuſtaining the whole preſſure and column of the body. Their proceſſes are wide and diſengaged, which enables them to perform whatever motion is required.

CIII.

Beſides this diviſion into vertebræ, the ſpine has alſo been conſidered as conſiſting of two pyramids, the upper and under one. The upper, the long one, is compoſed of vertebræ or bones, which turn on each other. The under, the ſhort one, is compoſed of falſe vertebræ, or bones which at an early period of life, reſemble the true vertebræ, but afterwards grow together, ſo as not to contribute to the motions of the trunk of the body. Theſe pyramids are joined together by their baſes.

CIV.

Though the regular vertebræ of the ſpine are twenty-four in number, which they do not exceed, yet the proportion of them to its ſeparate diviſions ſometimes varies according to the varying proportion of the body. Thus, where the loins are long, ſix inſtead of five vertebræ may belong to them, and only eleven be left for the back. In the ſame way, where the neck is ſhort, the back may come to have thirteen pieces; and again, if the neck is long, it may have eight pieces, and the back but eleven.

CV.

All the vertebræ agree in their general ſtructure, and as this ſtructure is moſt conſpicuous in the largeſt, we ſhall examine one belonging to the loins.

Every vertebra conſiſts of two leading parts, its body and its different proceſſes.

CVI.

The body of the vertebræ is that firm part for giving ſupport to the weight of the body, with an internal cavity for the paſſage of the ſpinal marrow, with two proceſſes above and below; by means of which it is articulated with the contiguous bones, with a tranſverſe one for the attachment of the muſcles, which turn the ſpine and a ſpinous one backwards, forming the ridge which diſtinguiſhes the ſpine, and gives it its name.

CVII.

The 1*ſt* part of a vertebra, or the body, is a large ſpongy bone, of a convex ſhape anteriorly, and flattened on the ſides. Behind, it forms ſomething of a ſemi-circle, to give a convenient lodgment by its cavity, for the ſpinal marrow. The covering of this part is thin in proportion to the ſize and ſubſtance of the bone. It is farther tipt with a ring of cartilage above and below, as a means of defence, and into the ſpherical hollow of this ring is received the ligament that connects it, and the two contiguous vertebræ. By this ſtructure, ſomething like a ball and ſocket is formed, though not completely. This body forms the principal part of the vertebra. It is that part which gives ſtrength and motion, and its ſtrength appears always proportioned to the weight it receives, and the motion required in it. Thus the vertebræ of the loins, as ſupporting the whole column, are largeſt in ſize, and poſſeſs a conſiderable motion, and the ſize of the body gradually leſſens in each as they advance upwards, the body of the cervical vertebræ being ſmalleſt.

2. The 2*d* part of each vertebra is its articulating proceſſes, which are a ſmall oblique projection from its body, having a ſmooth ſurface, connecting them to the articulation of the next bone, which is done by means of a ligament or elaſtic joining, and next by theſe proceſſes in the common form. From their oblique ſituation, theſe proceſſes are at times termed the aſcending and deſcending oblique proceſſes. The former connecting the vertebræ with the one above, and the latter with the one below.

3. Its ſpinous proceſſes form the 3*d* part of each vertebra, whoſe ſharp edges projecting are the ridge of the back, and give it its name. They riſe at the meeting of the arch or cavity for the ſpinal marrow behind, pointing from its middle, and they give attachment to the muſcles that raiſe and extend the ſpine, being powerful levers to aſſiſt their action.

4. The 4*th* proceſſes, the tranſverſe ſtand out as arms from the medullary cavity, and from their ſituation with reſpect to the ſpine, are ſo named. Like the former proceſſes, their uſe is to give inſertion to muſcles, and to act like levers in aſſiſting the ſame purpoſe, by raiſing and extending the ſpine.

CVIII.

Such is the general form of the vertebræ, but the peculiarities attached to each individual one, ſall to be examined in the different diviſions into which they have been arranged. Theſe peculiarities we ſhall find adapted to their particular uſes.

CIX.

The vertebræ of the loins are particularly diſtinguiſhed by the largeneſs and broadneſs of their body, by their ſhortneſs in reſpect to the height of their body, by the greater thickneſs of their intervertebral ſubſtance or cartilage, and by their ſeveral proceſſes being larger, more diſtinct, and fitter for the purpoſes of motion.

CX.

The vertebræ of the back differ from the former in the greater length of their body, ſhorter before, and flatter on the ſides, and more hollow behind, and in the thinneſs of their outer cartilage. Their proceſſes alſo are larger, and more acute. Their ſpinous ridge is more regularly arranged, and their tranſverſe proceſſes are ſhort, knobby, and more reſtricted in their motions. Beſides which, they are marked by the impreſſions of the ribs.

CXI.

The vertebræ of the neck are diſtinguiſhed by their flat ſurface before and behind, and by the ſmallneſs of their body, which the laſt of them entirely wants, and which the next alſo diſplays of an uncommon form, by their want of a hollow for the reception of the intervertebral ſubſtance, and by ſome of their ſpinous and tranſverſe proceſſes being divided or bifurcated.

CXII.

In ſtating the ſtructure of the vertebræ, it is to be obſerved that their tranſverſe proceſſes are perforated for the tranſmiſſion of the great vertebral artery through them. The protection of this artery by ſuch a channel, ſeems of great importance; for as there are only two that go to the head, it and the carotid, the former ſupplies the place of the latter, in caſes of obſtruction or diſeaſe.

CXIII.

The two firſt of the cervical vertebræ, by differing from all the reſt in their immediate connection with the head, diſplay alſo a difference of ſtructure for this purpoſe, which claims a more minute inveſtigation.

The *1ſt* is named Atlas, as giving the immediate ſupport to the globe of the head: the 2*d*, Dentatus, as forming the axis on which it moves.

CXIV.

The Atlas has no body, but inſtead of it a ſmall arch, and it may be conſidered as little more than a ſingle ring, with a flat ſurface backwards, poliſhed by the motion of the tooth-like proceſs of the next bone. It poſſeſſes, however, the articulating proceſſes, and there is a ſharp point, riſing perpendicularly upwards towards the occipital bone, to which it is held by a ſtrong ligament.

Upon either ſide, where the mark of the tooth-like proceſs of the dentatus is conſpicuous, a ſmall point projects, between which the tranſverſe ligament is extended, and then it divides the ring into two openings, one giving lodgement to the tooth-like proceſs of the dentatus, the other to the ſpinal marrow, and the rupture of this ligament no longer confining the tooth-like proceſs, allows it to injure the ſpinal marrow, and thus death is often produced. The only thick part of the atlas is its articulating proceſſes, which are in the middle of each ſide of the ring, and its oval ſmooth ſurface is joined upwards to the occiput, and downwards to the 2*d* vertebra. The form of theſe proceſſes on their upper diviſion is oval, ſomewhat hollow, and alſo oblique. By this means a nodding motion of the head is only permitted by them, and the rotatory motion is made by the conjoined action of the head and atlas turning on the tooth-like proceſs of the dentatus. The ſurface of the atlas above is ſomewhat hollow, to ſecure its connection with the head; and below again it is ſmooth, to facilitate its motion. The hole or perforation of its tranſverſe proceſs gives paſſage to the vertebral artery which makes an impreſſion or hollow upon the ring.

CXV.

The 2*d* vertebra, or the dentatus, derives its name from the tooth-like proceſs, or projecting point, on the upper part of its body. The figure of its body is conical, and this part of it is proportionally longer than any of the reſt of the vertebræ, and the opening through it for tranſmitting the ſpinal marrow is of a triangular form. Its ſpinous proceſs is alſo thick and ſtrong, to give origin to the muſcles which aſſiſt in the rotation and extenſion of the head, and it is turned downwards to allow theſe motions to be more readily performed. Its tooth-like proceſs is thick, long, and pointed; and from this point proceeds upwards the ligament that ties it to the hole of the occipital bone. Near its root appears alſo the ſmooth collar or neck on which it turns, encompaſſed by the ring of the atlas, ſo as to lock it as it were in its place. On each ſide of the tooth-like proceſs are ſituated like ſhoulders, its articulating ſurfaces.

CXVI.

Having thus examined the general ſtructure of the vertebræ, and particularly that of the two firſt, we are next led to conſider the common opening they form for the tranſmiſſion of the ſpinal marrow, and its branches in their diſtribution through the body.

CXVII.

Spinal Opening.

This opening is of a nearly rounded form, and to render its cavity ſafe for the lodgement of theſe delicate parts, it is every where lined with ſtrong coverings. The outermoſt encloſes the marrow by forming a ſheath or membrane round it, and it makes alſo the ſtrong ligament by which the ſeparate bones are connected to each other. As the medullary ſubſtance deſcends, it regularly diſtributes branches to every part, and from the interſtice of each vertebra, a branch or a nerve is ſent out on each ſide, which rating two for each of the twenty-four vertebræ, makes forty-eight in all, and their paſſage takes place by an opening through the ſheath or membrane, when they proceed under the articulating proceſs at the interſtices of the vertebræ.

CXVIII.

Intermediate or Inter-Vertebral Cartilage.

The inter-vertebral ſubſtance is a peculiar ſpecies of cartilage, of a ſoft pliant nature, and of a particular folded ſtructure, endued with wonderful ſtrength and elaſticity. It lies attached to the forepart of each vertebra, and is confined by means of a connecting ligament all round. This cartilage yields exactly to the motions of the body, and returns on any alteration of motion back to its place. By this ſtructure it is fitted for allowing all the regular exertions of the ſpine, without injury. It endures compreſſion, and yields under its burden; ſo that by the continued preſſure on it in the day, we are an inch ſhorter at night than in the morning. The ſame remark applies to its change in the progreſs of life, for in age by its yielding, the ſpine bends forwards; and at any period by a particular poſition increaſing the preſſure on a particular part of it, the inclination of the ſpine may be directed that way; and even extended in its effects to the vertebræ themſelves. From this cauſe ariſe thoſe diſtortions that happen in children and young people from tambouring, from diſeaſe, confining to a particular poſture, from carrying of children on one arm, &c.

CXIX.

Motions of the Spine.

The ſtructure of the ſpine thus deſcribed, fits it for the various motions its ſituation requires, and the extent of theſe motions is more or leſs limited in different parts of it. The greateſt latitude prevails in the neck, in the back there is almoſt none, and in the loins it is but confined. In the neck alſo there is a degree of turning which favors the motions of the head. In the back the motions conſiſt chiefly in bending forward, but in the loins, though limited, ſtill a conſiderable motion prevails, and the proceſſes here of the vertebræ are diſentangled and free, having a very great thickneſs of intervertebral ſubſtance. To perform their motions, each of the vertebræ is furniſhed with two diſtinct joints; for, *1ſt*, the

the intervertebral ſubſtance allows their motion to a ſufficient degree without interfering with each other; and 2*dly*, their articulating proceſſes are of the nature of a common joint.

CXXX.

Cheſt.

From the ſpine or back part of the trunk, we proceed naturally to the forepart or cheſt, the connection between them being formed by the ribs. This part is bounded by the ſternum before; by the ribs on each ſide, and the dorſal vertebræ behind. By the ribs the figure of the cheſt is moulded, and they form a covering and defence thrown over the lungs, as well as to aſſiſt theſe organs by their motions in the exerciſe of breathing.

CXXXI.

Ribs.

Each rib is divided into three parts, its bone, and its two extremities: at the end of its bone towards the vertebræ there is an articulating head and a knob, both to connect it with the vertebræ; at the other extremity is a pointed cartilage, which is received into a cartilaginous ſocket, or hollow of the ſternum.

CXXII.

Correſponding to the number of the dorſal vertebræ, the ribs are twelve in number, though like them they occaſionally vary, in ſome caſes there being thirteen, and in others only eleven. The ribs, like the vertebræ, undergo alſo certain diviſions; the ſeven upper ones from their connection with the ſternum being termed *true* ribs, and the remaining ſive being named *falſe* ribs, from their having no direct union with the ſternum, but by means of a ſeparate cartilage to which they are all connected, except the two laſt, which poſſeſs only a looſe attachment to the muſcles of the abdomen.

CXXIII.

In their figure, the ribs diſplay a convex form externally, by which their ſtrength is increaſed, and internally, they are ſmooth and concave, having their flat ſurface turned as a protection to the lungs. This flatneſs, however, is in ſome degree irregular, and accommodated to the degrees of elevation in the thorax, ſo that it may be always preſerved in its application to the lungs. The upper edge is alſo ſomething rounded, while the under one is more of a ſharp form, having a groove within it, for the intercoſtal artery and nerve, where they run protected.

CXXIV.

In detailing its ſtructure, each rib admits a diviſion, as already noticed, into different parts.

1. The *1ſt* is the round knobby head which connects it to the ſpine, and it is placed in the

interſtice between the two vertebræ, not directly againſt either.

2. The neck of the rib, where it is particularly ſmall and round, placed immediately before the head.

3. The tubercle of the rib, placed about an inch from the head, with a flat ſurface and irregular edge, to be articulated to the tranſverſe proceſs of the undermoſt of the two vertebræ, to which the head is joined.

4. The ſmall tubercle at the outerſide of the former, for the attachment of ligaments and muſcles from the ſpine, which fix and move the rib.

5. The angle of the rib, or the boundary between its round and flat part, where the lateral part of the thorax is formed.

CXXV.

Such is the general ſtructure of the ribs, but certain peculiarities attend individual ones. Thus the ſize and length of the ribs ſuffers a gradual decreaſe from the firſt to laſt, and thus a ſmall opening only takes place at the top of the thorax, while the lower opening equals the diameter of the abdomen. The 1*ſt* rib is the moſt crooked, the 2*d* is rounded in the ſame manner, and the 11*th* and 12*th* are exceedingly ſmall and delicate. The heads alſo of the firſt and two laſt are rounder than any of the others.

CXXVI.

Cartilage of the Ribs.

Like the ribs themſelves, their cartilages become alſo gradually larger, but contrary to what happens in the ribs, they approach nearer to each other in their deſcent. They form the edge of that cavity, over which the diaphragm has its principal attachment, and make the diviſion between the cheſt and belly. Like the ribs, the cartilages are flat in their outer and inner ſurfaces, and ſmooth where they are oppoſed to the lungs. In their connection with the ſternum, the cartilage of the 3*d* rib is the only one directly united, thoſe of the 1*ſt* and 2*d* ribs deſcend to touch it, and thoſe of the 4*th*, 5*th*, and 6*th*, riſe up in proportion to their diſtance from the central point. Each of the firſt five ribs have ſeparate cartilages, the 8*th*, 9*th*, and 10*th* have theirs connected with the cartilage of the 7*th*, and the two laſt ribs are unconnected, and lie looſe among the muſcles.

CXXVII.

Thus, by the peculiar junction of the ribs to the vertebræ, and their playing on a ſoft ſubſtance, is attrition from their conſtant motion guarded againſt. The tubercle alſo of the ribs, comes to be more ſupported by being joined to the tranſverſe proceſſes, and this junction adds alſo to its ſecurity, hinders the head of the rib from ſtarting out, and regulates its motion, by only admitting that kind of rolling motion, which the ribs poſſeſs in reſpiration. By the greater thickneſs of the dorſal vertebræ, and conſequently, diſtance of their tranſverſe proceſſes, a greater motion of the lower ribs than of the upper takes place, while from the elaſtic nature of the cartilages, they are alſo mechanically puſhed back; ſo that after death, the body is always in a ſtate of expiration.

CXXVIII.

Breaſt Bone (Sternum).

From the ribs or ſides of the cheſt, we proceed to the forepart of the ſternum. It is a long ſquare bone lying over the heart, and forming a defence to it, while at the ſame time it completes the cavity of the cheſt, and regulates by its ſupport of the clavicles, the motions of the ſhoulders.

CXXIX.

This bone varies in its ſtructure more than moſt others at different periods of life. In the fœtus it is compoſed of ſeven or eight pieces, which gradually unite, and in age form but one. At manhood it conſiſts of three pieces, one of which is cartilaginous, and it remains ſo till a very advanced period. It is in this ſtate we are to conſider it when its three different pieces are united by cartilage.

CXXX.

The upper or 1*ſt* piece of the ſternum is of a ſomewhat triangular ſhape, with its point placed downwards, and its baſe above ſomewhat hollowed for receiving internally the root of the trachea, and on each of its upper corners appears the hollow for the ſeat of the clavicles. Its ſides again are occupied by giving inſertion to the cartilages of the ribs. Thus in its ſtructure it is thick and broad above, and thin and narrow below, with its outer ſurface flat, and its inner ſlightly hollowed.

The 2*d* piece of the ſternum is ſquare in its form, and larger than the former, ſo that on its ſides its receives no leſs than the inſertion of eight ribs, there being upon it five diſtinct pits or indentations, and three joined by cartilage into one.

The 3*d* piece of the ſternum is properly a cartilaginous appendage to the bone, and continues ſo during the whole of life. From its pointed extremity it is named the Xiphoid, or ſword-like cartilage. The variations of its form are conſiderable in different ſubjects, for inſtead of the common form, it is ſometimes narrow like the point of a ſmall ſword, or turned obliquely to one ſide, or forwards or backwards, forked at the point, or perforated at the middle. Where theſe variations occaſion it to project much in any direction different from the common one, it is attended with bad conſequences, and in one inſtance the projection is mentioned as having extended to the navel. The point of this cartilage gives alſo a firm origin and ſupport to the abdominal muſcles.

CXXXI.

Baſin (Pelvis).

To finiſh the deſcription of the trunk, it remains to examine the baſin or pelvis, being that diviſion which ſupports the other parts, and connects them with the lower extremities. It may be conſidered as a ſtrong, wide, bony arch, forming the fixed point for moſt of the important motions of the body.

CXXXII.

The pelvis has been ſo named from its figure or reſemblance to a baſin, though its figure varies ſomewhat in different individuals, and it has been occaſionally conſidered as oval, eliptic, and triangular. In the fœtus and child it conſiſts of a number of pieces, which in the adult are reduced to four,—the two oſſa innominata, the ſacrum, and coccyx. The two firſt forming it anteriorly, and the two laſt compoſing it behind.

CXXXIII.

The Sacred Bone (Os Sacrum).

The os ſacrum, diſtinguiſhed alſo by the name of baſilare, forms with its appendage or the os coccygis, the column of the falſe vertebræ; the baſe of which is connected to the baſe of the true vertebræ, which is conſidered as terminating at the loins. The ſacrum therefore is originally a number of diſtinct vertebræ loſt in the adult, but ſtill viſible by the marks or lines of their former ſeparation, which wanting now the character and motion of vertebræ, are no longer entitled to the name. In the ſame manner as the other vertebræ, they poſſeſs alſo holes for the tranſmiſſion of nerves; and their rough and irregular ſurface on the back correſponds to the ſpinous proceſſes of the other vertebræ.

CXXXIV.

In its ſhape, the ſacrum is triangular, with its baſe attached to the ſpine. Its anterior ſurface is concave for enlarging the capacity of the pelvis, and ſmooth and flat, to permit the head of the child to paſs without injury. Its poſterior ſurface is rough, irregular, and ſpinous, for the attachment of large muſcles to give figure and ſtrength to theſe parts. With this figure, the ſacrum in proportion to its ſize is the lighteſt bone in the body, and the moſt ſpongy and cavernous in its texture. Hence it requires the ſtrong covering of ligaments and muſcles to defend it from injury.

CXXXV.

Like the other vertebræ, the ſacrum poſſeſſes a triangular cavity, which is a continuation of the medullary opening; and this cavity contains the termination of the ſpinal marrow; which, from being here branched out in a particular manner, is termed the cauda equina. The nerves ariſing from it paſs through the great holes on the fore-part of the bone, and the three firſt of theſe holes give exit to the branches which with the laſt of the loins compoſe the ſacroſciatic nerve that ſupplies the lower extremities, and is the largeſt in the body: while the two lower holes are occupied by the nerves that ſupply the pelvis.

The holes on the back of the ſacrum give alſo paſſage to the ſmall nerves of the hip and loins, though their opening is too conſiderable for this purpoſe alone.

CXXXVI.

This bone forms a connection at every point of its edge with other bones. Above it is joined to the laſt vertebra of the loins, and the projection formed by theſe two anteriorly, is termed the promontory of the os ſacrum; below, it is attached to the coccyx by a ſort of joint, moveable in men till 20, and in women till after 40. On each ſide it receives the deep indented rough ſurface of the haunch bone into its own ſurface, and this junction is rendered ſtrong and immoveable by the attachment of ſtrong ligaments and muſcles.

CXXXVII.

Rump Bone (Os Coccygis).

The os coccygis, or continuation of the ſacrum, is ſo named from its reſemblance to the beak of a cuckoo, and forms an acute point for the termination of the ſpine. At birth it is entirely cartilaginous; in the progreſs of childhood it is gradually forming into bone, and between its ſeparate pieces the interpoſed cartilage continues long viſible, and allows a degree of motion particularly between the firſt and ſecond piece. In its figure, this bone is roundiſh or broad, and flat above, and tapering below. Behind it is convex, and forms a curve forwards which ſupports the end of the rectum, and contracts the lower part of the pelvis. It conſiſts of four diſtinct pieces in young ſubjects, though they are ſometimes reduced to three, and one of them is conſidered as belonging to the ſacrum. It poſſeſſes no cavity, nor does it tranſmit any nerve or veſſel.

CXXXVIII.

Nameleſs Bones (Oſſa Innominata).

The oſſa innominata, or nameleſs bones, ſo termed from their irregular ſhape, fill up the ſides and forepart of the pelvis. In the child they form three diſtinct parts, and this diſtinction is generally preſerved in their deſcription. Theſe parts are the ilium, iſchium, and pubes.

CXXXIX.

Haunch Bone (Os Ilium).

The ilium or haunch bone conſtitutes the upper and largeſt part of each os innominatum; and ſpreads out to aſſiſt in ſupporting the contents of the abdomen. On it alſo lie the ſtrong muſcles of the thigh, and it forms the rounding of the haunch. It is divided into two principal parts, the flat upper part named its ala, and the low rounder part termed its body.

CXL.

The ala or wing is diſtinguiſhed into ſeveral different parts, for

1. Its whole circle is edged with a firm ridge of bone, which originally in the child is a diſtinct cartilage. This ridge is termed the ſpine, and gives attachment to the lower oblique and tranſverſe abdominal muſcles.

2. Its ſpinous proceſſes, which are four abrupt points, two at its fore and two at its back part, the former give attachment to the rectus muſcle of the thigh, and to the glutæus muſcle; the latter are leſs conſiderable, conſiſting merely of two rough projecting points near its articulation with the ſacrum, which ſerve partly for the origin of muſcles, and partly to give a firm inſertion to the ligaments which fix this joint.

CXLI.

The back of this bone is covered by the great glutæi muſcles, and the coſta or inner concave ſurface gives origin to the internal iliac muſcle. The ſurface of this bone is broad and rough; and in the form of its connexion with the ſacrum, it is impoſſible that motion can take place.

The nameleſs or acute line, which runs upon the internal ſurface of the bone, divides the ala or wing from the ſocket, or forms the lateral part of the brim of the pelvis, and the line of diviſion between it and the abdomen.

CXLII.

Hip Bone (Os Iſchium).

The iſchium, or hip bone, is the loweſt part of the pelvis, and is placed perpendicularly under the os ilium. It is the part on which we ſit, and forms the largeſt ſhare of the ſocket for the head of the thigh bone. The figure of this bone is irregular, and it is divided into three parts into the body; the bump or tuberoſity, and the ramus or branch.

The body, or the upper thick part, forms near one half of the ſocket for the thigh bone, from its upper part it ſends backwards the ſpinous proceſs for the attachment of muſcles and the ſacrosciatic ligament.

The tuberoſity, or round knob, is that part on which the body reſts in ſitting. It is remarkable as giving attachment to the inferior ſacroſciatic ligament, and to the greater part of the flexor muſcles of the leg. This bone forms alſo a mark for the ſurgeon in directing his inciſion in lithotomy, by making it in the middle between the anus and this bone.

The branch or ramus of the iſchium goes obliquely upwards and forwards to be connected with the pubis. Its edges, from being turned a little forwards and backwards, form the one the arch of the pubis; and the other, the thyroid hole. This part alſo gives attachment to a number of muſcles.

CXLIII.

Share Bone (Os Pubis).

The os pubis, or ſhare bone, is the ſmalleſt diviſion of the innominatum. It takes its name from being covered with the mons veneris, the hair on which part marks the age of puberty. It forms on each ſide the anterior portion of the pelvis, and is diſtinguiſhed into its body, its angle, and its branches. Its body, or ſuperior part, is thick, ſtrong, and forms the upper and forepart of the acetabulum. Its part of the ſocket is both ſmall and ſhallow, but the bone grows broad and flat as it approaches the ſymphyſis. Over the middle of the bone paſs out of the pelvis, the iliac and pſoas muſcles, flattening its ſurface where they run. The angle, or ſymphyſis, is that part of the pubes where, by the intervention of a cartilage, its portions from each innominatum are joined, or conſtitute what is called its arch. At the very ſpot of the joining, as the bones riſe a little higher, this is termed the creſt of the pubes, and from it the ſmall pyramidal muſcles of the abdomen riſe. The branch or ramus of the pubes is that part which, with the branch of the iſchium, compoſes the foramen ovale, or edge of the thyroid hole.

CXLIV.

Extremities.

From the trunk which we have now examined, we are led to the remaining part of the ſtructure, the extremities. They are divided into the ſuperior and inferior; the latter of which, as being connected with the pelvis, we ſhall firſt deſcribe.

CXLV.

Inferior.

The inferior extremities are compoſed of the thighs, legs, and feet.

CXLVI.

Thigh (Femur).

The thigh bone is the longeſt in the body, and the thickeſt and ſtrongeſt of the cylindrical bones. It ſupports the whole weight of the trunk, and that chiefly on its head, though placed in an apparently unfavorable direction for this purpoſe. Indeed one thigh bone frequently does this itſelf. The thigh bone is very regular in its ſtructure. It is divided into

1. Its body, very thick, bent forwards, and of a roundiſh form above, but ſomewhat triangular

about its middle. By this bending, greater power is given to the action of the muſcles. It is the effect of original formation for this purpoſe, and it takes place in various degrees in different perſons.

2. Its head or ball, which is ſmooth, covered with cartilage, and forming almoſt two thirds of a ſphere. It is received into the deep ſocket formed by the acetablum of the os innominatum; and to render its joint ſtronger, its ſocket is both tipped with cartilage, and the joint is alſo ſtrengthened by the round ligament, which ſhews a rough pit, at the under and inner part of the ball.

3. The neck, which is much longer than that of any other bone, being an inch and half in length, and paſſing obliquely downwards and outwards from the ball, to allow a free motion of the body of the bone in various directions; and, by its length, its head is more fully fixed in its ſocket; and, by its width, its motions are allowed to be free and unembarraſſed by the pelvis. The trochanters placed on the neck, are the largeſt proceſſes in the body for the inſertion of muſcles, receiving their name from their office of turning the thigh. The firſt of them, placed at the outer part of the neck, is that great bump ſo plainly felt by applying the hand on the haunch; and ſerves for the inſertion of the glutæi, and all the

large muſcles that ſerve for the outward motion of the thigh. The ſecond ariſes on the inner ſide of the bone, lower than the former, and ſerves for the inſertion of the flexor muſcles of the thigh, or thoſe that bend it towards the body. Between the two trochanters is a rough line for the inſertion of the capſular ligament, being the commencement of the next part, the linea aſpera.

4. The linea aſpera, or ragged ridge on the back of the bone, extends to its lower part, and gives attachment to numerous muſcles which paſs from the pelvis to the thigh, and from the thigh to the leg. This line is ſingle in the middle, and is forked at each end, as it paſſes to the condyles.

5. The condyles are the two bumps into which the bone ſwells at its lower part; they are divided into the internal and external condyles. The internal is larger and deeper than the external, to compenſate for the obliquity of the thigh, and to give leſs obliquity to the leg. Betwixt the condyles is placed the cartilaginous pulley at the forepart of the bone, with its outer ſurface higher than its inner one, to be adapted to the motion of the patella. On the back part, between the condyles, is ſituated a deep notch, which contains the great veſſels and nerve of the leg. Below the middle of the bone there is a paſſage for the medullary veſſels, and ſmall arteries enter through its porous extremities.

CXLVII.

On this ſtructure of the thigh bone, it may be obſerved that the ſecurity of its joint is particularly guarded by the deepneſs of its ſocket; and the neck ſtands wide in order to allow a free motion of the joint. The trochanters are next formed large, that they may give a proper inſertion to the muſcles. The body of the bone is thick and ſtrong, capable both of ſupporting weight, and bearing the action of the muſcular powers applied to it. By the ſwelling of the condyles, a broad ſurface is afforded for its junction with the knee.

CXLVIII.

Leg.

The leg is compoſed of three bones, the tibia, fibula, and patella.

Tibia.

The tibia is ſituated at the inner part of the leg, and derives its name from its reſemblance to a trumpet, expanded at top, and circular below. Its junction with the thigh is peculiar, its bone being merely appended to the former, and ſecured by ligaments, the number of which expoſes it to diſeaſe.

The tibia is divided into

1. Its upper end, forming a large head, which is thick and ſpongy, and is divided on its upper ſurface into two ſuperficial cavities, which are impreſt

as it were by the condyles of the thigh bone. Between theſe cavities there riſes a rough protuberance or high ridge, pitted on its fore and back part for the attachment of the anterior and poſterior crucial ligaments. On the upper and fore part, there is alſo a tubercle for the inſertion of the lower tendon or ligament of the patella. In addition to this, there is alſo obſervable, under the outer edge of the head of the bone, a cartilaginous or articulating ſurface, like a ſlight dimple for the connexion of the thigh bone with the head of the fibula; and this connexion is of the ſlighteſt kind, being merely laid upon it.

2. The body of the tibia diſplays a triangular form, and its acute angles run along its whole extent. The anterior angle, called the ſpine or ſhin, is a little waved, and extends from the tubercle to the inner ancle; and at the head of this ridge is ſituated that tuberoſity, into which is inſerted the ligament of the patella. Through its whole extent, this line can be traced through the intermediate ſubſtance. The 2*d* angle is turned directly backwards, and is leſs acute than the former; and the 3*d* one is turned towards the fibula, to receive the interoſſeous membrane that connects the two bones.

3. The under head of the tibia forms the principal ſhare of the ankle joint. It is ſmaller than the upper head, correſponding to the different ſize

of the two joints of the knee and ancle. Its projecting or pointed part conſtitutes the inner ancle, and the outer ancle is compoſed by the lower end of the fibula applied upon a hollow or ſemilunar cavity of the tibia formed to receive it. The front of the tibia forming the inner ancle, even protrudes beyond the joint, and ſerves in a certain degree as a guard to it.

CXLIX.

The tibia is one of the largeſt and ſtrongeſt bones in the body, and is neceſſarily ſo, in order to ſupport its whole weight, which it does without any aſſiſtance from the contiguous bone or fibula. Externally, its ſubſtance is thick, and its plates are firm and ſtrong. Internally, it is cavernous and cancellated. It derives alſo additional ſtrength, both from its general form, as well as from its ridges. Its ancle proceſſes are ſo directed as to give an obliquity to the foot, a circumſtance much ſtudied both in the ſituation of the bone here, as well as the ſoft parts.

CL.

Fibula.

The fibula may be conſidered as an appendage to the tibia, chiefly for the purpoſe of forming the ancle joint. It is a long ſlender bone, the moſt ſo of any in the body, and is a uſeful ſupport to the tibia in caſes of its fracture or diſeaſe.

The fibula in its ſhape is triangular, and has two knots, one at each extremity. The upper one, or the looſe head, has a ſuperficial ſmooth cavity towards its inner ſide, to be articulated with the tibia, where it is tied by ligaments of ſuch ſtrength, as to allow very little motion; and in this way is its want of ſtrength, in its connexion with the bone, compenſated by its cloſe circumjunction with ligaments.

Its under knob, or head, is chiefly employed in making the outerpart of the ankle joined with the end of the tibia. On the inner ſide it is enabled to form ſuch a connexion with the bones of the foot, that a complete hinge is compoſed, firm and ſtrong, and capable of every motion. Thus the fibula forms a neceſſary addition to the leg by giving additional ſtrength to the tibia, by allowing a more extenſive inſertion of its muſcles, and ſupporting the tibia when affected by diſeaſe. Its chief uſe however is, the ſhare it poſſeſſes in the formation of the ancle.

CLI.

Knee-Pan (*Patella*).

The patella or knee-pan, completes the ſtructure of the leg. It is of a triangular flat ſhape, the anterior ſurface of which is convex, and perforated by numerous holes for the inſertion of tendons and ligaments which cover it. The poſterior ſurface is ſmooth, and divided by a longitudinal prominent ridge into two cavities. Into the upper point of the patella or baſis of its triangle, is inſerted the four great muſcles that extend the leg. The lower extremity of the patella is tied down by a ligament attached to the tubercle of the tibia immediately under the knee, and by which it is ſo firmly reſtricted as to appear but a part of the tibia.

The uſe of the patella is chiefly to extend the power of the muſcles of the leg, by moving their direction farther from the centre of motion in the manner of a pulley. Thus when the knee is at reſt, the patella ſinks down into the hollow of it; and when the muſcles begin to act, it gradually riſes up ſo as to increaſe their power. It alſo ſerves to defend the articulation of the knee from external injury.

CLII.

Inſtep (*Tarſus*).

The tarſus or inſtep, is compoſed of ſeven bones, by which is formed an arch, poſſeſſed of a proper firmneſs and elaſticity to ſupport the body. Theſe properties it derives from the number of pieces of which it is compoſed, and from the ſtrong junction of theſe pieces by proper ligaments.

The firſt bone of the tarſus is termed the aſtragulus, which, by its union with the bones of the leg, forms the joint of the ancle.

The 2*d* is the heel bone, (*Os Calcis*,) or end of the arch that ſupports the body.

The 3*d* is the boat-like bone, (*Os Naviculare*,) which connects the three ſmall bones with the firſt.

The 4*th* is the cuboid or cubical bone, (*Os Cuboides*,) that joins alſo the ſmall bones to the heel bone.

The remainder are the ſmall bones themſelves, of a wedge-like ſhape, termed therefore cuneiform, immediately occupying the ſeat of the ſhoe-buckle, and giving attachment to the next diviſion of the foot, or metatarſal bones.

CLIII.

Aſtragulus.

In deſcribing the tarſal bones, the aſtragulus is the moſt important. Its ſmooth head is received into the ſcaphoid cavity of the tibia; and by its connexion it forms a pulley poſſeſſing an extenſive motion.

This motion, however, is only forwards and backwards, and it is facilitated by the ſmooth arched ſurface of the bone, covered with cartilage and lubricated. The ſides of the bone are alſo plain, ſmooth, and covered with cartilage. Its under part conſiſts of a deep foſſa or depreſſion, which divides it into an anterior and poſterior articulating ſurface. The latter of theſe is large and concave, and by it, it is connected with the upper and middle part of the os calcis.

The former is irregular and convex, where it plays upon two ſmooth cavities at the inner and forepart of the os calcis, and upon a cartilaginous ligament, extended between it and the os naviculare.

CLIV.

Heel Bone (Os Calcis).

The heel bone, or os calcis, is large and irregular, and is the end of the arch of the foot. From the rough point of it, on which we ſtand, proceeds the tendon Achillis; and by this roughneſs, a firm inſertion is given to it. Next to this point of inſertion of the tendon, is its irregular articulating ſurface for its connexion with the aſtragulus. A 3*d* articulating ſurface, or poſterior prominence, attaches it to the os naviculare; and a ſort of arch, or large cavity downwards, gives paſſage to the tendons of the long flexors of the toes, and to the veſſels and nerves of the ſole of the foot.

CLV.

Boat-like Bone (Os Naviculare).

The boat-like bone, or os naviculare, is ſituated at the fore part of the aſtragulus, and inner part of the foot. It is a flattened circular body, with riſing borders, and its poſterior ſurface receives the head of the aſtragulus in the manner of ball and ſocket. Its anterior convex part receives the three cuneiform bones, and is divided as it were into three articular ſurfaces for this purpoſe.

CLVI.

Wedge-like Bones (Oſſa Cuneiformia).

The wedge ſhaped bones, or oſſa cuneiformia, form the fore part of the tarſus, and are placed at the inner ſide of the cuboid bone. They are laid to each other like the ſtones of an arch. Their upper part is flat where they are covered with ligaments, while their under part is irregular for the attachment of muſcles and ſtrong ligaments lying in the ſole. Of the three bones, the leaſt is placed in the middle, the largeſt is appended to the great toe, and the middle ſized one is appended to the metatarſal bone of the third toe, and joins alſo the os cuboides.

CLVII.

Cuboid Bone (Os Cuboides).

The cubical bone, or os cuboides, placed at the fore and outer part of the tarſus, is next in ſize to the aſtragulus. It joins the laſt cuneiform bone and the os calcis, between which it is wedged, and forms as it were an arch within an arch, increaſing both the ſtrength and elaſticity of the ſtructure, ſo that the body reſts on a double arch; the points of the one are the heel and great toe, while the metatarſal bones form the other.

CLVIII.

Having thus examined the bones of the tarſus, we next conſider thoſe of the metatarſus, which are five in number, and ſo named from being placed upon the tarſus. In reſpect to their general appearance, their bodies are long, arched upwards, and tapering towards their anterior extremities. Their extremities are large in proportion to their bodies, and the poſterior ones much larger than the anterior, in order that they may be implanted with greater ſecurity in the tarſus; while the anterior ones connected with the toes, are ſo conſtructed by their ſmall round heads, as to permit a greater freedom and eaſe of motion. The metatarſal bone of the little toe projects over the tarſus, and forms a jutting which can be eaſily felt externally.

CLIX.

The laſt part of the foot is formed by the toes, which are five in number, and conſiſt each of three diſtinct pieces or bones. Theſe, from the manner in which they are diſperſed, are termed phalanges, or ranks.

The great toe has two of theſe phalanges, and each of the others, three. The joints formed by the bones are round and free, in order to admit an eaſe of motion. The under ſurfaces of the bones are a little depreſſed or flattened, forming a groove, where the tendons of the flexor muſcles are lodged.

CLX.

Seſamoid Bones.

To complete the oſteology of the lower extremities, the ſeſamoid bones remain to be mentioned. From their ſmall ſize, like peaſe, they are compared to the ſeeds of the ſeſamum, or oily grain. They are generally found in the ſeat of tendons, and at particular points of them, where they ſuffer much friction. Hence they are moſt conſpicuous at the roots of the thumb and great toe; ſerving the ſame purpoſe as is aſſigned by anatomiſts to the patella. In their outer ſurface they are convex where applied to the ligament or tendon, and concave in their inner, or next the joint where they are lined alſo with cartilage. They are ſometimes found at the roots of the other ſingers and toes, at the condyles of the thigh, &c.; ſo that their appearance would ſeem caſual, and the effect of accident rather, as regular deſign.

CLXI.

Superior.

From the inferior, we aſcend next to the ſuperior extremities, which, like the former, are compoſed of three diviſions, the ſhoulders, arms, and hands, which are all, indirectly as it were, appended to the trunk by means of a ſeparate or intermediate bone on each ſide, which merely glides upon it.

CLXII.

Shoulder Blade (*Scapula*).

This bone is the ſcapula or ſhoulder blade, ſituated upon the upper and back part of the thorax, at a diſtance from the ribs, the interval being filled up with fleſhy ſubſtance. It is a bone thin in its ſtructure, and formed originally of two plates, with an intermediate diploe; which by preſſure becomes gradually condenſed and thinned in the progreſs of life. Its remarkable parts are,

1. Its ſmooth flat ſide, having a ſuitable bend to anſwer the convexity of the ribs, and laid upon the cheſt with its ſubjacent muſcular ſubſtance that allows it to glide; by which means two motions are performed by it: the 1*ſt* being the motion of the ſhoulder bone upon the ſcapula, and the other the motion of the ſcapula itſelf upon the ribs. By this muſcular ſubſtance alſo, the hollow of the ſcapula is marked by numerous inequalities.

2. Its irregular outer ſide, rendered ſo by the action of different muſcles, divided by its ridge or ſpine croſſing the bone, and forming a ſmall upper and large under ſurface. All theſe parts are thickly covered with muſcles, which take their name from their ſituation with reſpect to this ridge.

CLXIII.

In deſcribing the ſcapula, its figure is triangular, one of the angles being placed downwards. The upper line of the triangle is diſtinguiſhed by receiving the muſcles that raiſe the ſhoulder upwards, and is named the ſuperior coſta or border, being alſo the ſhorteſt. The lower border, or inferior coſta, is free and unincumbered in its motions; and receives no muſcles but the two ſmall ones, or teres, which pull down the arm bone. The baſe of the bone, or poſterior coſta, is ſomewhat thick and ſwelled out, and into it are inſerted a number of muſcles which move the ſcapula in various directions, according to the various ſets of their fibres. On the point of the ſcapulary triangle, is placed the glenoid cavity, lined with cartilage, for the articulation of the os humeri; and towards this point the bone terminates in a flat ſurface, ſo ſhallow indeed as to receive only a ſmall portion of the ball of the os humeri, though deepened a little by a circular cartilage that tips it. To the containing capſular ligament, therefore, the defence of the os humeri is chiefly entruſted; which riſes from the bordering griſtle of the cavity: hence its eaſy luxation from the ſmall hold the os humeri poſſeſſes of the bony cavity.

CXLIV.

The moſt remarkable part of the ſcapula is its ſpine, or that ridge, which traverſing its upper ſurface, divides it into two, and gives attachment to the ſupra and infra ſpinatus muſcles. It is ſmall at its beginning, and becomes higher and broader in its courſe forwards, forming at its termination the high promontory, or tip of the ſhoulder. It is flattened at top, and from the ſlight inverſion of its edges to either ſide, ariſe two tendinous membranes, which go the one to the upper, the other to the under border, dividing the bone into two cavities. The ſpine alſo receives part of the trapezius muſcle, between its root and the baſe of the bone.

Next to the ſpine itſelf, is the acromion proceſs, or end of it, named the top of the ſhoulder, which by forming a turn or diſtortion, and overhanging the joint, ſerves as a protection to the ſhoulder bone, and prevents luxation upwards. In the ſame manner is the joint farther defended by the coracoid proceſs, which ariſes from the neck of the ſcapula, and ſtands directly forward with a crooked ſharp point, compared to the beak of a crow. The joint of this proceſs gives origin to muſcles, and from its ſide, a ſtrong ligament goes acroſs to be fixed to the acromion, for the protection of the joint. Thus, by theſe three parts, the glenoid cavity, and the acromion and coracoid proceſſes, is the hollow for receiving the ſhoulder bone compoſed, and what this joint[illegible]ants in actual ſtrength, is ſupplied by the eaſe and freedom of its motions, which allow it to yield, and thus elude any reſiſtance made againſt it.

CLXV.

Collar Bone, or Clavicula.

The clavicle is ſituated between the upper part of the breaſt bone and the top of the ſcapula, where it acts as a ſupport to the ſhoulders, and bears them off the trunk of the body. The chief parts of this bone are its two ends.

1. The *1ſt*, termed the thoracic or ſternal extremity, is round and flat, ſo as to fit a correſponding hollow on the upper part of the ſternum.

2. The *2d*, or ſcapular, is flat where it lies over the joint of the humerus, touching the acromion but in one point, and where they touch each other, they are tipt with cartilage, and are afterwards tied with ſtrong ligaments by which the clavicle is enabled to form a fixed point of connection between the ſcapula and trunk.

CLXVI.

Arm Bone (Os Humeri).

From the ſcapula and clavicle, we are led to the humerus or arm bone, which is placed at the ſide of the thorax and under the ſcapula. It is one of the moſt perfect cylindrical bones, round in the middle, flattened towards the lower end, and regular and round again at the upper end. Its remarkable parts are at its upper part.

1. The head or ball, which is a large and regular part of a circle, having but a ſlight hold from the ſhallowneſs of the glenoid cavity that receives it, and it is therefore eaſily diſplaced.

2. The neck or line, into which the capſular ligament is implanted, which allows the bone an extenſive motion in every direction.

3. The tubercles of this bone, which are two ſmall bumps of unequal ſize, and diſtinguiſhed from each other accordingly. They are ſituated behind the head of the bone, and receive the great muſcles which move the arm.

4. The groove or ſpace between the tubercles, which is deep for the reception of the long tendon of the biceps muſcle, and is covered with cartilage to render it ſmooth.

CLXVII.

Where the bone flattens at its under part, and changes ſomewhat of its former ſtructure, the parts deſerving notice are:

1. The two ridges that lead to the condyles for the attachment of ſtrong tendinous faſciæ, which give origin to part of the muſcles of the forearm, and allow them a broader extenſion.

2. The two condyles or projections themſelves, which are two ſharp points ſtanding out from

either ſide of the joint for the attachment of muſcles, and which give theſe muſcles a longer fulcrum and more powerful action. The outer condyle is ſmalleſt, and gives origin to the extenſor muſcles; while the inner, larger than the former, gives attachment to the flexor muſcles with which we graſp. It is alſo ſituated ſomewhat lower than the other, which rendering oblique the articulation of the elbow, makes the hands naturally fall upon the breaſt, with a tendency in them when brought together to croſs.

3. The intermediate articulating ſurface, which, ſtanding betwixt the condyles, limits the motions of the joint to thoſe of a hinge.

4. The cavities within the joint or capſule, for receiving certain proceſſes of the bones of the forearm. One on the forepart receives the coronoid proceſs of the ulna, in the flexion of the forearm. The other at the back part of the bone receives the olecranon of the ulna in the extenſion of the forearm,—or that proceſs which makes the joint of the elbow.

CLXVIII.

Forearm.

After the humerus, follow the bones of the forearm, which are two in number, the radius and ulna. The former ſo named from its reſemblance to the ray or ſpoke of a wheel, the latter from its uſe as a meaſure.

Radius.

The ſituation of the radius is at the outer part of the forearm, and this bone belongs peculiarly to the wriſt, turning with the hand in all its rotatory motions, and carrying the wriſt with it ſo as to be termed the handle of the hand. The parts of this bone deſerving a particular demonſtration are,

1. Its upper end or head, covered with cartilage, and formed into a circle, hollowed above for receiving the outer part of the articular cavity of the os humeri, where it bends and extends upon that bone along with the ulna, and alſo for being articulated with the ulna itſelf, at its coronoid proceſs.

2. Its neck, immediately behind the round head, ſurrounded in the ſubject by a circular ligament which keeps the bone in its place, and allows it to roll upon the ulna.

3. Its tubercle or prominent bump at the under and inner part of the neck, which is the point for the inſertion of the biceps flexor muſcle of the arm.

4. Its body, which is longer than that of the ulna, as on it the ſtrength of the arm depends, which is convex alſo on its outer and back part; and rounded by the muſcles which cover it. Between it and the ulna is placed the interoſſeous ligament.

5. Its lower head, which differs from the upper, in being broad and flat to receive the bones of

the wriſt; and it is formed into a cavity of an oval form lined with cartilage, for admitting the two firſt bones of the carpus, named from its ſhape the ſcaphoid cavity; while at the edge of the bone next the thumb, it ends in a peak or ſharp point, named the ſtyloid proceſs of the radius..

CLXIX.

To conclude the deſcription of this bone, it may be obſerved, that while the ſcaphoid cavity forms the joint of the wriſt, there is alſo a ſemilunar cavity at the inner ſide of this under end of the radius lined with cartilage, that receives the correſponding extremity of the ulna, upon which the radius rolls, carrying the hand with it.

CLXX.

Ulna or Cubit.

The ulna is placed at the inner part of the forearm, and is of a triangular form, becoming gradually ſmaller as it deſcends to the wriſt. The moſt remarkable part of it is its connection with the humerus at the elbow. This connection is formed by a deep notch that cloſely embraces the humerus, termed the ſigmoid cavity of the ulna; and this cavity is guarded before and behind by two proceſſes, the olecranon and coronoid proceſs. The *1ſt* of theſe compoſes the large bump of the elbow, which is received into a deep hole of the humerus, and ſerves both to increaſe the power of the extenſor muſcles, and to prevent a forward luxation of the part. The 2*d* or coronoid proceſs riſes perpendicularly on the forepart of the bone. Like the former, it increaſes the action of the muſcles, and protects the part from luxation backwards. Thus the elbow joint conſiſts of the ſigmoid cavity, protected on each ſide by the olecranon and coronoid proceſs, and on the outer ſide of this laſt there is alſo a ſmaller cavity, receiving the ſame appellation of ſigmoid, and giving place to the round head of the radius on which it rolls. The next part of this bone are its ridges or ſides. The chief of them turned to the radius, has an interoſſeous ligament paſſing between them attached to it, which ſtrongly connects the two bones together, and gives a firm hold to muſcles. The lower end of the bone forms a ſmall round head, which is covered with cartilage on that ſide where the radius moves upon it, and alſo on its extremity, where it is oppoſed to a moveable cartilage placed between it and the carpus. The laſt part of the head is a ſmall rounded point, which gives adheſion to a ſtrong ligament that goes off to be fixed to the bones of the wriſt, and this is termed its ſtyloid proceſs. Thus the olecranon and ſtyloid proceſs form the two extremities of the bone, eaſily felt externally, and hence employed at times as a meaſure.

CLXXI.

The Hand.

The hand, the laſt diviſion of the upper extremities, is the moſt complex in its form, and conſiſts of three parts, the carpus, metacarpus, and fingers. Externally, this part is convex, and internally, concave, ſuited to its office of graſping and retaining ſubſtances.

CLXXII.

Wriſt (Carpus).

The carpus conſiſts of eight diſtinct but irregular pieces, divided into two unequal rows; which, from their diſpoſition, form outwards an arch, with their broad ends turned in this direction. The individual pieces at one end of this arch are cornered and irregular, and their form is very little repreſented by their names.

CLXXIII.

Firſt Row.

1. The firſt of them is termed the os ſcaphoides or boat-like bone, which is the largeſt of the whole, and is received into the ſcaphoid cavity of the radius. Its chief points are its round cartilaginous ſurface, ſmooth, and fitted to the correſponding hollow of the radius, and its projecting proceſs forming a corner point of the carpus, and giving attachment to a part of the ligament that fixes the tendons of the wriſt.

2. The 2*d* of the carpal bones is the os lunare, ſo named from its ſhape, nearly of the ſame ſize with the former, and joined like it to the radius. Together they form a ball fitted to the ſocket of the radius, and of ſuch a length as to render it in its motions a proper hinge. The chief parts of this bone are its lunated edge, turned towards the ſecond row, and its round head forming the ball of the wriſt joint.

3. The 3*d* of the carpal bones is the os cuneiforme or wedge-like bone, ſo named from its ſituation, by being locked in among the others. Its ſide, forming the convex of the hand, is broad. Its point towards the palm of the hand is narrow, and by being cloſely wedged between the cuneiform and piſiform bones, it is ſomewhat entitled to its name.

4. The 4*th* of the carpal bones is the piſiform or pea-ſhaped bone. It is placed upon the cuneiform bone, and forms that prominence which is readily felt in the wriſt, and is one of the points of the arch under which the tendons paſs. It is very moveable, and can be rolled about. It is alſo the point into which is inſerted one of the ſtrong ligaments for bending the wriſt.

CLXXIV.

Second Row.

1. The 1*ſt* bone of the 2*d* carpal row is the os trapezium, ſo named from the four unequal

edges of its poſterior ſurface. Its chief parts are the great ſocket for the metacarpal bone of the thumb, placed a little to one ſide and next its proceſs, which makes one of the corner points.

2. The next bone, termed trapezoides, much reſembles the former, except in ſize, being ſmaller, and in its ſituation it is wedged in betwixt the two adjoining bones.

3. The os magnum is the largeſt of the carpal bones placed at the inner ſide of the former one, and in the centre of the upper row.` Its round head or ball is received into the hollow ſurfaces of the os ſcaphoides and lunare in the manner of a ball ſocket, ſo that the ſecond row by this means moves upon the firſt.

4. The laſt of the carpal bones, named the unciform or hook-like bone, is large and ſquared. In its ſituation it is wedged between the os magnum and cuneiforme. Its chief or remarkable part is its long flat hook-like proceſs, projecting far into the palm of the hand, and forming the laſt and higheſt of the corner points. This proceſs alſo gives a firm origin to the great ligament by which the tendons of the wriſt are bound down.

CLXXV.

All the articulating ſurfaces of the carpal bones are covered with cartilage. They are ſecured to each other by many ſtrong ligaments of every form, and thus united, they may be conſidered as but one joint. Hence their firmneſs reſiſts almoſt always luxation; and from their being placed in the manner of a wedge, broad externally, and with their ſmaller ſurface towards the palm, their arch ſupports whatever weight is applied to them; and it is only the diſplacement of one that can beat in the other.

The articulation between the firſt and ſecond row of the carpal bones, allows motion to each ſide, but chiefly forwards and backwards; though the motion is leſs extenſive than between the fore-arm and wriſt.

CLXXVI.

Part annexed to the Wriſt (Metacarpus).

The metacarpus conſiſts of four bones for ſupporting the fingers, and one on which the thumb is founded. In their ſtructure they are big and ſtrong, cloſely united at their carpal baſe, and ſwelling out as they proceed to be articulated with the fingers. Externally, the ſurface of theſe bones is convex, and internally, ſomewhat concave, as forming part of the palm of the hand. By the flatneſs of their lower heads, they are firmly implanted into the bones of the carpus, and poſſeſs the ſame degree of motion with them. By the ſize of their heads, they are kept aſunder from each other; and room is given for the interoſſeous muſcles. By their divergent form, their appendages, the fingers, come naturally to ſpread out.

The only motion required in them, is bending towards a centre, by which they increaſe the hollowneſs of the hand, of which they compoſe the far greater part.

CLXXVII.

Fingers.

The fingers are compoſed each of three rows of bones or phalanges. Theſe different phalanges taper a little as they deſcend, and their baſes are longer than their middle and inferior extremities. The poſterior ſurfaces of the fingers are convex, and chiefly covered by the tendinous expanſions of the extenſors of the fingers. Their anterior ſurfaces are flat, and in ſome parts concave, for lodging the tendons of the flexor muſcles.

The *1ſt* bone or phalanx of each finger, articulated with the metacarpal bones, forms a ball and ſocket; and has therefore an extenſive or rolling motion. The ſecond and third phalanges, articulated with each other, are more limited in their motions, and compoſe only a hinge.

CLXXVIII.

Differences of the Skeleton.

Having examined the general ſtructure of the ſkeleton, we are now prepared for conſidering the differences which takes place in individuals, as ariſing from the three circumſtances; of period of life, of ſex, and of ſpecies.

CLXXIX.

Skeleton of the Child.

The difference that exiſts between the ſkeleton of the child and of the adult, conſiſts in the imperfect oſſification of parts; of courſe, in the greater number of the pieces, and in the extent of cartilage ſupplying the place of bone. Thus, when we deſcend into particulars, we find,

Head.

In the head, inſtead of ſutures, as in the adult, the bones are joined by membranous expanſions in the child, and the radiated appearance of the ſibres in the broad bones are at this period conſpicuous. In the cranium, the frontal bone conſiſts of two pieces, and the ſuperciliary holes and frontal ſinuſes at birth are not yet formed. In the parietal bones their ſides are incomplete, and there is no parietal hole. The occipital bone is even divided into four pieces. In the temporal bones the ſquamous is ſeparated from the petrous part, and the meatus externus is a cartilaginous ring. A cartilaginous partition divides alſo the ethmoid bone, which is afterwards formed into the naſal plate and criſta galli. Of the ſphenoid bone, the temporal wings are ſeparated from the body, and there are no ſphenoid ſinuſes. In the bones of the face, the differences are leſs obſervable than in thoſe of the head, as the bones are in greater number, conſequently of ſmaller ſize, and the oſſification therefore, even at firſt, is more advanced in them. In the ſuperior maxillary bones, however, the ſinus is only beginning to form; the os unguis ſhews a diſtinct ſeparation and ſuture. The under jaw is alſo compoſed of two pieces, joined together by the intervention of cartilage.

CLXXX.

In the Trunk.

In the trunk the differences are leſs obſervable, from the great proportion of cartilaginous parts. The ſternum, however, in the child is found compoſed of ſeven or eight pieces. The os ſacrum is compoſed of five diſtinct pieces, which have intervertebral cartilages, the ſame as the true vertebræ. The os coccygis is alſo entirely cartilaginous, and the oſſa innominata are diſtinctly ſeparated into three diviſions; of theſe diviſions the ſpine of the ilium, and that part of the bone which belongs to the acetabulum, are cartilaginous. The ſpinous proceſs, the tuberoſity and crus of the the os iſchium, are alſo of a ſimilar texture; and the crus of the os pubis, and that portion of it which forms the acetabulum, are alſo at this period in the ſame cartilaginous ſtate.

CLXXXI.

In the Extremities.

In the extremities the apophyſes of the bones are all epiphyſes in children. The long bones alſo ſhew diſtinctly their longitudinal fibres. The patella is entirely cartilaginous at birth, and the bones of the carpus are in a ſimilar ſtate.

CLXXXII.

Skeleton of Old Age.

Such are the chief diſtinctions between the ſkeleton of the child and of the adult. But while the number of pieces is increaſed by infancy, ſo they are proportionally diminiſhed by the gradual progreſs of life, and in age this prevails to ſuch a degree, that the cranium is often found to form but one ſolid piece or whole, without any marks of former diviſion. The motions of the vertebræ become in the ſame manner loſt; every part of the cartilaginous ſtructure advances to ultimate ſolidity; and by this change of the ſofter texture, the functions fall to be impaired.

CLXXXIII.

Skeleton of the Female.

The differences between the male and female ſkeleton, are at all periods of life conſpicuous; and they are diſplayed both in the general ſcale of the body, as well as in the ſtructure of particular parts.

CLXXXIV.

Thus the bodies of women appear to be conſtructed on a ſcale proportionally ſmaller than thoſe of men, and their bones ſeem to be leſs and more ſlender. The ſurfaces, and the various depreſſions and cavities conſpicuous in the male, are leſs diſtinct in the ſemale, marking a leſs vigorous action of the ſoft parts upon them.

Head.

When we deſcend more minutely into particulars, we find in the head,

That the circumference of the ſkull is larger than in the male.

The os frontis is more frequently divided by the ſagittal future.

The frontal ſinuſes are obſerved to be narrower, and all the bones of the face more ſlender and delicate.

CLXXXV.

Trunk.

In the trunk, the bodies of the vertebræ are longer, and alſo the intervertebral ſubſtance or cartilage is deeper and thicker; a circumſtance which, perhaps, prediſpoſes more than in the male to diſtortion in this part, on any exciting cauſe being applied.

The upper part of the thorax is alſo proportionally wider than in the male, and the under part is narrower; ſo that on the whole the cheſt in the female is leſs conical.

The true ribs alſo, are longer in their cartilages in proportion to their bony part, and broader and flatter to ſupport the more extended ſurface of the female breaſts.

The ſternum is alſo more raiſed, though its length is ſhorter than in the male, for it terminates in the female at the *4th* inſtead of the *5th* rib.

The thorax in the female is placed altogether at a greater diſtance from the pelvis, and the length of the loins is likewiſe greater than in the other ſex.

CLXXXVI.

But the diſtinctions are ſtill more remarkable in the pelvis of the ſexes, and they require a more ſpecial attention than elſewhere. Theſe diſtinctions are particularly connected with the ſeparate office of child bearing the female is deſtined to perform. Thus, while the male pelvis is large and ſtrong, its openings ſmall or confined, and its bones of great ſtrength; the female one is wide, ſhallow, large in its cavity, and capacious in its openings. It is this part which particularly marks or characterizes the figure of the two ſexes; for the proportions of the manly figure require the ſhoulders broad, the haunches narrow, and the thighs in a direct line with the body. While thoſe of the female again are contracted ſhoulders, a broad haunch, the thighs large, round, and ſet at a greater diſtance, ſo that the knees approach. Hence the firmneſs of ſtep in men, and the tottering unſteady gait of women.

CLXXXVII.

But in tracing the different proportions of the pelvis, we obſerve that the brim in the female is more eliptic, approaching leſs to a circle than in the male; that the alæ of the ilia ſpread out more extenſively. That the crura of the pubes are more expanded, and that the arch they form is leſs acute. That the angle of the vertebræ recedes alſo to a greater diſtance backwards; and that the ſacrum is more deepened, poſſeſſing a greater convexity behind. That the inferior opening alſo is larger, appearing ſo at firſt ſight. That the tuberoſities of the iſchia are placed more outwards; and that the lateral openings of the pelvis are all of a larger ſize. That the coccyx is both turned more backwards; and alſo poſſeſſes a greater degree of motion than in the other ſex.

CLXXXVIII.

In deſcending from the pelvis to the extremities, we remark that in the female, the oſſa femorum are more curved; the neck of the thigh bone forms a greater angle with the body; and the internal condyle is larger. The feet are alſo ſmaller.

In the ſuperior extremities, the bones are ſhorter; the ſcapulæ are ſmaller, and their angles more acute; the clavicles are leſs crooked; the oſſa carpi are narrower; and the fingers more tapering towards their extremities.

CLXXXIX.

Skeleton of the Negro.

Nor is the difference between the ſpecies, or between the white and negro, leſs remarkable than the difference between the ſexes. Thus, in examining the ſkeleton of a negro, the cranium is diſtinguiſhed in its figure by the narrow and retracting forehead and hindhead; by the flat bone of the noſe, by the great diſtance betwixt the noſe and mouth, by the ſmall retracting chin, by the great diſtance betwixt the ear and the fore part of the mouth; by the ſmall diſtance between the foramen magnum and back part of the head, by the large bony ſockets which contain the eyes, by the wide meatus auditorius, and by the long and ſtrong under jaw.

The other diſtinctions lie chiefly in the extremities, and conſiſt of the long forearm, of the bones of the thigh and leg more gibbous, of the flat foot, and of the particular length, breadth, ſhape, and poſition of the os calcis.

CXC.

Chemical Analyſis of Bones.

Thus the bones we have ſeen form the foundation of the body, and are the baſis on which all the other parts reſt. Before concluding the demonſtration of them, it is proper farther to examine the principles of which they are compoſed, as unfolded by chemical inveſtigation.

CXCI.

From this inveſtigation it appears that the bones are not ſimple earthy matters; but conſiſt of four different principles.

1. An animal jelly, which is diſplayed by cutting them in pieces, raſping them, and boiling them in water; which becomes viſcid, and loaded with gelatinous matter.

2. A medullary oil or marrow, which we have ſeen contained in a particular membrane, ſerving for the nouriſhment of the bones.

3. An animal earth, which conſiſts of calcarious earth and phoſphoric acid; the latter of which is ſeparated by pouring on calcined bones, ſulphuric acid.

In the fœtus, this animal earth forms a third part of the bones; in the adult it forms about a half; but in old age it greatly exceeds this proportion.

4. A fibrous gluten or mould, in which the animal earth is depoſited, which appears by macerating bones for a long time in vinegar or diluted nitrous acid; when they diſmiſs their earth, and become ſoft and bend.

CXCII.

Recent Bones.

In their recent ſtate, the bones are chiefly diſtinguiſhed from their appearance in the ſkeleton by their colour, which is various; ſome being white, ſome red, and ſome bluiſh. The more compact the ſubſtance of the bone, the whiter is its colour; and the more ſpongy its ſtructure, the more is its colour varied.

CXCIII.

This variety of appearance depends principally on the ſize and number of the blood veſſels diſperſed through them.

CXCIV.

Hence this cauſe occaſions a conſiderable difference in the colour of the bones at different periods of life. Thus the bones of adults are white, but thoſe of children are reddiſh. In the prime of life alſo, the bones are manifeſtly redder than in old age; when the number of veſſels gradually decreaſes.

Particular mode of life has likewiſe a conſiderable influence on the colour of the bones. Thus hard labour occaſions the bones of the ſame age to have a greater whiteneſs than indolence and inactivity; and the uſe of mercury particularly prevents a white appearance of the bones.

CXCV.

Along with the conſideration of this difference of the bones in their recent ſtate; the appendages alſo which belong to them, the perioſteum and marrow, require a ſpecial notice.

CXCVI.

Perioſteum.

The perioſteum we formerly mentioned is that thin membrane which every where covers the external ſurface of the bones. It is of a compact cellular texture, cloſely connected to the bones by the intervention of blood veſſels and ſmall filamentous threads; and if denuded of the bones, its expanſions would retain the general appearance of the ſkeleton, ſo extenſively is it ſpread. It conſiſts of ſeveral layers condenſed together, and though not itſelf vaſcular, it is through it that veſſels are tranſmitted to the bone. Hence, while the bone is reddened by an injection, the perioſteum is little affected. It forms the medium of nouriſhment to the external layers of the bone, in the ſame manner as the marrow does to the internal ones. Hence an injury of the perioſteum produces exfoliation of the bone, or in other words, the death of the external layers; its veſſels alſo gradually decreaſe in the progreſs of life, as the bones require leſs nouriſhment; or rather, they are turned into connecting filamentous threads, inſtead of veſſels. Beſides forming in a certain degree the medium of nouriſhment to the bones, this membrane allows the parts above, particularly the muſcles, to ſlide eaſily upon them By it the different pieces of bone become connected, and a general uniting medium between the bones, or the hard and ſoft parts, is compoſed by it.

CXCVII.

Marrow (*Medulla*).

The marrow is contained in a fine membrane inveſting the inner cavity and cells of bones. It is a ſecretion from a number of minute arteries ſpread upon its ſurface, and paſſing into its cells to depoſit their contents. In theſe cells, or bags, which it forms, is the marrow locked; the uſe of which is to convey the ſame nouriſhment to the internal parts of the bone, which the perioſtium does to the external. Hence any injury of the marrow produces a complete death of the bone, while that of the perioſteum produces only a partial effect, or exfoliation of the outer part. This membrane or veſicular ſtructure for the marrow, which prevents its being effuſed when expoſed to the heat of boiling water, is ſupported in its place by the bony filaments of the reticular ſubſtance, or cancelli of the bones. The tranſmiſſion of the marrow to the bones is of the firſt importance. It is inſinuated between the plates of the hardeſt of them, and even in the ſkeleton the tranſudation of it through them is conſpicuous. The ſenſibility of the medullary covering is conſidered as ſmall by moſt authors, but it acquires a high degree of it under diſeaſe. Very little tinge can be given to this ſubſtance by injections of madder, and the preſence of lymphatics in it has therefore been doubted. Its connection indeed ſeems ſtronger to the ſecretion or marrow than to the bones, for it can even be drawn out entire from the cavity of a bone.

CXCVIII.

Different periods of life change this ſecretion or marrow in its appearance, and this change is connected with the decreaſe of the circulation to the membrane. Thus, in infancy, by its numerous veſſels it is red; in manhood, yellowiſh; and a deep yellow in old age. In the ſame way, in the latter period, the bones acquire a brittleneſs, and are eaſily fractured from a defect of its ſupply.

CXCIX.

Chemical Analyſis of Marrow.

In ſubjecting the marrow to chemical experiment, it appears an oil mixt with jelly. Its conſiſtence is thinner than the fat of every other part of the body. In embryos it is almoſt gelatinous, and after death, opake. It yields the ſame products as other oils, with the addition of a ſubſtance of the conſiſtence of butter.

CC.

To finiſh the demonſtration of the ſkeleton, the only bones that remain are the teeth, which are bones of a peculiar ſtructure, and formed for the particular purpoſes of maſtication, and the articulation of the voice.

Teeth (Dentes).

Teeth are the hardeſt and whiteſt of the bones. They are originally wanting, or rather do not appear till a neceſſity ariſe for their uſe, and from this cauſe they are unfolded at different periods, which occaſions dentition to be divided into different ſtages. In the adult, or at full maturity, there are thirty-two in both jaws; and this number they never exceed, though they ſometimes fall ſhort, and have been found only twenty-eight.

CCI.

In its general ſtructure, each tooth is diviſible into three parts; its body, its neck, and its fang. The body is that part which appears above the gums, its fang or root is that part buried in the ſocket or jaw, and its neck is the intermediate line between the two, cloſe to the edge of the gum, and marked by a ſlight circular depreſſion.

CCII.

In its ſubſtance, each tooth conſiſts of its enamel or outer covering, and its oſſeous part, or internal ſtructure. The former of theſe is a ſubſtance peculiar to teeth, hard, white, and compact, and only allotted to that part of them ſituated without the ſocket. In its formation it conſiſts of a fibrous or ſtriated texture, having its fibres directed from the circumference towards its centre. The thickneſs of the enamel is generally not more than the one-eighth of an inch, though it varies a little at different parts, being gradually thinner towards the neck, and thickeſt and ſtrongeſt at the ſurfaces or active extremities.

The oſſeous part of the teeth is the ſame as other bone, only in the teeth it would appear to receive a cloſer condenſation than elſewhere. It comprizes the whole of the tooth except the outer covering of the body by the enamel.

CCIII.

Though from their very condenſed ſtructure it is impoſſible to demonſtrate the vaſcularity of teeth in a great degree, yet the circumſtances which attend their diſeaſed ſtate clearly ſhew their poſſeſſion of circulation, ſenſibility, and abſorption, the ſame as prevails in the ſoft parts.

CCIV.

Each tooth diſplays an internal cavity, opening at the point of the fang, and gradually enlarging as it extends to its body. This cavity receives a ſupply of blood veſſels and nerves, which are thus diſtributed through the teeth; and the obliteration of this cavity in age, renders the tooth callous and inſenſible.

CCV.

The teeth poſſeſs two appendages, the perioſteum and gums; the former common to them with other bones, and extending from the fang to the neck, where it cloſes in, or becomes attached to the gum. The latter a peculiar red ſubſtance, or inveſting cuſhion, covering the alveolar proceſſes, leaves a perforation for each tooth through its highly vaſcular and hard elaſtic texture. The degree of its hardneſs is very great in infancy, and it has even a ridge extending through its whole length, which is loſt in age.

CCVI.

The teeth, from their ſhape and offices, are divided into three different claſſes, the inciſores, canini, and molares.

The inciſors are the four teeth in the fore-part of each jaw. In examining them, they have each two ſurfaces that meet in a ſharp edge. Their anterior ſurface is convex, and their poſterior one ſomewhat concave, and being uſually broader and thicker, eſpecially the two firſt in the upper jaw; it falls over thoſe of the under jaw.

The canini derive their name from their reſemblance to the tuſks of a dog, and they are at the ſame time the longeſt of all the teeth. Their fangs are larger than thoſe of the inciſors and they are placed one on each ſide the inciſors in each jaw. Their baſe appears in form of a wedge pointed in the middle.

The molares, or grinding teeth, are ten in each jaw. They differ from the former in their uſe, as well as in their ſtructure. Inſtead of a ſingle fang or root, they have two in the under, and three in the upper jaw; and they likewiſe differ from themſelves, as well as from the other claſſes. Thus the two firſt poſſeſs a form between the inciſors and molares. They poſſeſs, like the inciſors, but one root; but they terminate like the caninus, in two points, of which the anterior one is higheſt. The two next grinders are much longer, and their ſurface poſſeſſes five protuberances, two on the inner, and three on the outer ſide. The laſt molaris is ſhorter and ſmaller than the reſt, and ſo late in its appearance, as to receive the name of the Dens Sapientiæ.

CCVII.

The formation of the teeth takes place at a very early period. About the fourth month, the alveolar proceſs is found only a ſhallow longitudinal groove, divided by ſlight ridges into a number of intermediate depreſſions, which compoſe at laſt the future alveoli or ſockets. But in the fœtus there is found only the outer ſhell of five deciduous teeth, and of one permanent tooth on each ſide the jaw. Between the inner ſide of the deciduous teeth and the alveoli in the fœtus, little capſules are placed, and connected by proceſſes with the gums, in which the inciſors and canini are afterwards formed; but at this time there is no appearance of the rudiments of any of the teeth. The firſt appearance of the teeth, is the filling of the alveolar depreſſions with ſmall pulpy ſubſtances, included in a vaſcular membrane. In forming the teeth, the ſurface of this pulp firſt begins to harden, the oſſification proceeding from one or more points, according to the kind of tooth that is to be formed. Thus the inciſors and canini diſplay but one oſſifying point, the molares four or five.

CCVIII.

By the progreſs of this oſſification, the pulp is gradually converted into bone; and on its under ſurface, laſt of all, the fang comes to be formed. The bony part receives then a cruſt of enamel, which is ſecreted in a manner not yet explained, and is equally compact before as after birth. During the progreſs of the enamel, the lengthening of the fang or root takes place; and according to the number of fangs, the points of oſſification to form them are conſpicuous. By the growth of the fang, the tooth is puſhed upwards; and accordingly makes its appearance beyond the gum, about the *5th*, *6th*, or *8th* month; although we find on the one hand, inſtances of children who have been born with them; and on the other, where they have not appeared till a late period. In the former caſe, their number is confined to the inciſors. They have even at times been diſcovered in fœtus of ſeven or eight months, but in all ſuch premature examples, they have undergone a rapid decay in the courſe of a few weeks or months from their firſt appearance. In the latter caſe they have been known ſo late as from thirteen to nineteen months, before their firſt marks of protruſion.

CCIX.

The common order of protruſion, is a ſubject that ſhould be much attended to. In each tooth, two ſtages of its progreſs may be remarked: the one, is the ſtage of its increaſe or growth; the ſecond, of its progreſs to appearance, or actual denudation. The ſymptoms of the firſt are often both nice to diſcriminate, and alſo moſt fatal at times to the conſtitution of the child. Thoſe of the ſecond are generally denoted by certain external marks.

CCX.

From examining the form of the teeth, it will occur that the difficulty of protruſion muſt depend on their departure more or leſs from an acute or pointed figure; and, alſo, according as the ſtate of the parts obſtructs their progreſs. Hence, as the inciſors poſſeſs both an acute form, and as the jaw is there thinneſt, their protruſion falls to be firſt. The two ſmall inciſors of the lower jaw, cut the gum about the ſeventh month, or earlier. They follow each other in about fifteen days. The large ones of the upper jaw appear nearly at the ſame time, after which the ſide ones of the lower jaw appear in courſe, and are followed by the ſame in the upper jaw, and thus the inciſors are complete. At eleven months, the canini of the lower jaw, which form the ſecond order in point of acuteneſs of form, divide the gum; and, in the courſe of ſome days after, are accompanied by thoſe of the upper jaw. At a year old or upwards, two ſmall molares advance in the lower jaw; and in a few days are joined by thoſe in the upper. The remaining four are generally not ſeen till two years of age or upwards; and when appearing, they complete the milk teeth, or firſt ſet. But the interval between the different teeth is by no means ſo exact as here ſtated; and often a very conſiderable lapſe of time, intervenes between them.

CCXI.

The firſt ſet, or milk teeth, twenty in number, are remarked by authors, as diſtinguiſhed by their ſuperior whiteneſs and regularity. It has even been ſuppoſed by ſome anatomiſts, that they had no root; but this opinion is combated with his uſual force by Albinus. At the ſame time, there is no doubt that the root is deſtroyed in part by the time they fall, or are ſucceeded by a ſecond ſet; and that even the ſeptum of the ſockets is obliterated. This naturally happens as a conſequence of preſſure by the ſecond ſet, in their progreſs to protruſion.

The firſt ſet is completed by the age of three years; and in ſtrong robuſt children by 2½, but ſeldom ſooner. Their protruſion, or the firſt dentition, forms the moſt critical period in infancy; and from it the future ſtate of delicacy in childhood is often to be traced.

CCXII.

The ſecond ſet, or adult teeth, replace the milk teeth from the age of ſeven to fourteen, during which the former ſet are gradually ſhed. Theſe permanent teeth are all found in a diſtinct ſet of alveoli, and by the increaſe of the latter, ſo as gradually to obliterate the former alveoli, their teeth drop out, and they totally diſappear. But beſides this, the ſecond ſockets are larger, and acquire alſo additional teeth, or three grinders on each ſide, by the lengthening of the jaw for this purpoſe. Hence the face, from the ſhortneſs of the jaw, is flatter and rounder in children than in adults.

CCXIII.

Theſe laſt molares cut the gum at different periods. The firſt generally paſſes at twelve years of age, the ſecond at ſeventeen or eighteen years, and the third, or Wiſdom Tooth, not till twenty or thirty, ſometimes not till thirty-five.

Though two ſets of teeth are the common portion of moſt individuals, yet, in ſome rare inſtances, a third ſet has made its appearance after the age of ſixty. This appearance has commonly been attended with other peculiar circumſtances, marking ſomewhat of an effort of nature towards a complete renovation of the ſyſtem.

CCXIV.

The form of the human teeth, thus examined, appears different from thoſe of all other animals. Thus the canini are not longer than the reſt, nor yet curved as in the beaſts of prey. The inciſors are not ſo ſharp as in animals, and the molares are flatter and more blunt in their edges. From theſe peculiarities therefore, man is deſigned for a different or mixt aliment, and is fitted equally to live on animal or vegetable diet.

CCXV.

Chemical Analyſis of Teeth.

Teeth conſiſt of two parts, bone and enamel. The analyſis of bone was formerly examined as conſiſting of jelly, medullary oil, earth with phoſphoric acid, and gluten. The enamel again differs from this, in being entirely phoſphate of lime, cemented by gluten.

CCXVI.

Anatomical Preparation of Bones.

In ſtudying anatomy, it is neceſſary to prepare the bones for uſe; and this is done either naturally or artificially.

Natural Skeleton.

1. The natural ſkeleton is confined to young ſubjects. It is formed by removing every part from the bones, except the connecting ligaments and cartilages, which are to be carefully avoided. When the parts are removed, the body is then to be macerated in clean

water, which is to be changed every day; and this proceſs is to be continued till putrefaction advance ſo far, that a ſeparation of all the remains of the ſoft parts can be made by diſſection. When this is finiſhed, the body is to be again laid in water for a day or two; and afterwards, for a few days into lime water, or a ſolution of potaſh. It is then waſhed clean, and hung up to dry. In this preparation, the arms are removed from the trunk, and again artificially joined. The brain is alſo ſcooped out through the bregma, or the trephine is applied for the ſame purpoſe.

Artificial Skeleton.

2. The artificial ſkeleton is generally preferred to the former, as the ſubjects of it are adults, or bodies at full growth, It is made by diſſecting the fleſh as much as poſſible from the bones; then ſeparating the bones to ſuch an extent, that they can be laid in a veſſel. When laid there, they are to be covered with water, which is to be every day changed for about a week. After this, it is to remain unchanged, occaſionally filling it up, ſo as to keep the bones covered till putrefaction remove all the remains of the ſoft and ligamentous parts, which requires a period from three to ſix months, according to the circumſtances of the ſtate, and temperature of the ſeaſon. To facilitate the cleaning of the long cylindrical bones, holes may be bored in them to allow the acceſs of the water to their cavities, and the corruption of the medullary matter.

3. When putrefaction has ſo far taken place as to deſtroy the ligamentous parts, the bones are in a ſtate to be cleaned or to be ſcraped from all ſuperfluous

adhering matter. When this is done, they ſhould be then ſteeped for a few days; afterwards immerſed in a ſolution of potaſh, or in lime water for a week; and then waſhed clean, and ſubmitted to dry. This is to be done beſt, by expoſing them to a gradual heat.

4. In preparing the bones of the artificial ſkeleton, the head requires particular attention. It is ſubmitted to maceration like the other bones, after firſt making numerous inciſions through the ſcalp, to facilitate the ſeparation of the ſoft parts; and when putrefaction has ſufficiently advanced, they will eaſily ſeparate. The bones are then to be ſcraped, and the brain evacuated through the foramen magnum, by firſt breaking it down, and introducing for this purpoſe ſomething through the aperture. To ſeparate the bones of the cranium, the head muſt then be filled with dried peas well ſhaken in, ſo that it may be completely crammed. In this ſtate, it is to be put in water, ſo that the peaſe may ſwell, and occaſion a uniform preſſure on its internal ſurface, by which a ſeparation of the principal bones at the ſutures will take place; and this ſeparation may be afterwards eaſily extended. The head of a young ſubject ſhould always be preferred for this purpoſe.

5. The bones thus prepared and dried in order to form the ſkeleton, muſt be properly and conveniently arranged, and then joined by means of ſlender flexible wire.

The lower jaw is to be fixt in its ſituation by paſſing wire through its condyloid proceſſes and each temporal bone, in order to bring the articulating ſurfaces into contact; and this fixing ſhould be ſo made, as to preſerve the motion of the jaw. The anterior portion is to be prevented from falling down by a ſpiral wire fixt to the os ſphenoides; and its end to the middle of another wire, extended from one angle of the jaw to the other, in the form of a bell ſpring.

The atlas, or firſt vertebra, is then to be fixt by means of wires paſſed through it and the baſe of the occipital bone, in ſuch a manner as may beſt confine its natural ſituation, no motion being neceſſary between it and the parts to which it falls to be connected. Acroſs its opening, a ſtrong wire is next to be placed, forming on its anterior part a circle fit to admit the end of the finger; and through this circle the upper end of a large wire is to paſs, upon which the vertebræ are ſtrung.

6. This wire in ſize ſhould not exceed a large gooſe quill, and on it all the vertebræ are to be ſtrung in their proper order, and in its incurvation the natural bend of the ſpine is to be imitated, and holes paſſed through the body of each vertebra to admit it. Its lower end ſhould enter the ſacrum, on the inner ſide of which, an inch from the top, a hole being driven, the wire is to be there ſecured by a pin. The cartilages of the vertebræ are to be imitated by thin circular pieces of cork, $\frac{3}{8}$ inch thick anteriorly, and ſloped off in the form of a wedge, which are to be interpoſed for ten or twelve joints above the ſacrum. Their thickneſs alſo ſhould be gradually leſſened as they advance upwards, till it come to $\frac{1}{8}$ inch; and, when the ſpine is complete, theſe pieces ſhould receive a covering of flour and water, mixt with a ſmall proportion of burnt umber. The end of the wire connecting the vertebræ, is to be paſſed through the

circular wire of the atlas, and then through the foramen magnum above the ſuperior part of the cranium, where it is to be confined by a nut, ſcrewed upon the top of the wire, cloſe to the bone.

7. The ribs are next to be united to the tranſverſe proceſſes of the dorſal vertebræ by ſlender wires through their poſterior extremities; and, in doing this, the lower ribs muſt be firſt articulated on each ſide, advancing upwards.

When their poſterior extremities are thus connected, their anterior ones are to be ſupported by narrow ſlips of leather, formed in imitation of their cartilaginous appendages, which connect them with the ſternum. In forming theſe ſlips, the ſtructure of the parts muſt be attended to. Theſe ſlips are to be fixed to the ribs by making in the ribs a perpendicular ſlit about ½ inch deep, with a ſaw to admit them; and to this ſlit the extremity of the leather is to be adapted, and then ſecured by glue or a pin. The ſame joining may be made to the ſternum, by introducing the ends of the leather into the natural ſituation of the cartilages. When finiſhed, the application of paſte over the joinings, will render the appearance natural.

The clavicles are next to be placed in their natural ſituation, and ſecured to the ſternum by ſlender wire paſſed through them; and to the ſcapula they may be articulated in the ſame manner.

The ſcapulæ are to be connected with the trunk by means of wires paſſed through their inferior angles, and the ribs ſituated immediately in this ſituation.

8. In the bones of the pelvis, the oſſa ilii are to be

joined to the lateral edges of the ſacrum, by paſſing two ſtrong wires through the outſide of the poſterior part of the ilium from ſide to ſide, and piercing the thick part of the ſacrum at the diſtance of 1½ inch from each other; which wires are to be ſecured at its extremity, by placing a nut with a ſcrew upon them.

The ſame connection may be made between the ſides of the oſſa pubis, by paſſing one or more wires from ſide to ſide, and ſecuring them by rivets. The cartilage of the ſymphyſis is to be ſupplied by a ſmall piece of cork plaiſtered over; and the os coccygis is to be articulated with the point of the ſacrum by a tin plate and two pins.

9. The extremities are more difficult to connect than the head and trunk.

In the ſuperior extremities, the connection is made by making a longitudinal oblique inciſion with a ſaw, an inch deep, through the head of the humerus; and fixing in this part a ſcrew 2 inches long, the upper half of which being flattened, and having a hole for a cork near its top, ſecures the bone in its ſituation by paſſing the wire laterally through its head; and at the ſame time admits in the bone a freedom of motion. The projecting part of the ſcrew again is to be fixed in the glenoid cavity of the ſcapula, and ſecured by a nut.

The elbow, the next part, is articulated by a tin plate and pins. A circular piece of plate, an inch in diameter, is fixed edgeways in a longitudinal direction into the ridge of the notch formed by the curvature of the olecranon, and kept in its place by paſſing two pins from ſide to ſide. The projecting part of the tin is next to be received into a ſlit made with a ſaw in the lower end of the humerus; where being confined by a pin paſſed through it and the bone, by this mode of connexion a freedom of motion will be permitted.

The upper extremity of the radius is joined to the anterior proceſs of the ulna by a ſmall oblong piece of tin plate, one end of which being fixed tranſverſely in the outer ſurface of the proceſs, the projecting end is received into a tranſverſe inciſion of the lateral ſurface of the radius at its articulation. This inciſion is made with a ſaw about $\frac{1}{4}$ of an inch from its ſuperior extremity; and the plate is confined in its ſituation by a pin paſſing longitudinally through it, and ſecured to the bone. The lower extremity of the ulna is articulated to the radius in a manner exactly ſimilar to the upper one, and therefore does not require repetition.

The two radial bones of the wriſt are joined to it by two oblong pieces of tin plate, and ſecured by pins in the manner already deſcribed, ſo as to admit of flexion and extenſion.

The carpal and metacarpal bones are to be confined in their ſituation by wires paſſed through them in a convenient direction.

The thumbs and fingers are joined by ſmall oblong tin plates, properly adapted for the purpoſe. Each plate is to be fixed in the upper extremity of the bone, by ſlitting each bone longitudinally with a ſaw to a proper diſtance to receive it; and the plate is then ſecured by paſſing a pin laterally through the bone, and in this way ſufficient motion will be permitted.

In the lower extremities, a junction with the pelvis is made by ſlitting the head of the femur as far as its neck with a ſaw longitudinally. Into this part a ſcrew, two inches and a half long, and flattened for one half its length, is to be fixed; and this ſcrew is to be ſecured by a tranſverſe pin, paſſed laterally through the head of the bone, and through a hole made near the flat part of the ſcrew. The projecting end is then to paſs through a perforation in the middle of the acetabulum, and is to be confined by a nut paſſed over it within the pelvis; while, at the ſame time, it is done ſo as to allow a freedom of motion.

To the tibia, again, the femur is connected by a ſlip of tin plate, about 4 inches long, and $\frac{3}{4}$ broad; which is to be doubled acroſs its middle, ſo as to bring the two ends even. The inner ſurfaces of the tin are to be cloſely applied to each other, except at the bend; where an open loop is to be formed for the paſſage of a wire about the ſize of a crow quill. The two extremities of this tin plate are to be inſerted perpendicularly into the poſterior edge of the articulating ſurface of the tibia, ſo as to project from the bone about an inch; that the loop may be ſituated tranſverſely between the two condyles of the femur, when the bones are naturally placed. They are then to be connected by paſſing a wire tranſverſely and laterally through the condyles near their poſterior ſurfaces, and through the loop of the tin plate. That part of the plate inſerted into the tibia, is to be ſecured by two pins driven into its poſterior ſurface, ſo as to pierce the plate in two different places.

The patella is joined to the anterior edge of the ſuperior extremity of the tibia by a tin plate 2 inches long, and $\frac{1}{4}$ inch broad; paſſing upward into the inferior edge of the patella, and downwards into the anterior edge of the ſuperior extremity of the tibia; where it is ſecured by a pin driven into the bones in ſuch a direction, as to pierce the tin plate.

10. The fibula is connected to the tibia at its two extremities by two oblong tin plates, fixed into four ſlits made perpendicularly with a ſaw through the centre of each articulating ſurface, and ſecured by pins paſſed tranſverſely through the bones and plates, in the manner already deſcribed.

11. The tibia, at its lower extremity, is to be joined to the aſtragulus, by introducing a tin plate into a ſlit made in each perpendicularly with a ſaw, and ſecuring the plate by pins paſſed tranſverſely, one through the tibia, and another through the aſtragulus; and, by a hole in each end of the plate, the natural flexion and extenſion of the part will be allowed.

The os calcis is to be ſecured in its ſituation by connecting it by wire to the aſtragulus, and that in the moſt convenient manner. In like manner is the ſcaphoides to be united to the anterior part of the aſtragulus, and the other bones of the tarſus may be joined in a ſimilar way.

12. The metatarſal bones may be connected to the correſponding tarſal ones by wires or tin plates, as employed for the fingers. A wire ſhould be paſſed tranſverſely through the anterior extremities of theſe bones to unite them to each other, and keep them in their places.

The bones of the toes are to be joined to the metatarſal bones by tin plates in the ſame manner as deſcribed in the fingers; or elſe a wire may be paſſed through the under part of the thick anterior extremity of the metatarſal bones longitudinally, and through the centre of the bones of the toes, ſecuring the wire at the end by a ſmall clinch.

13. By this manner of forming the bones into a ſkeleton, or placing them in their natural ſtate, the ſtudy of oſteology is facilitated; but, in order to underſtand farther the intimate ſtructure of bones, or to demonſtrate their particular parts, different modes of preparing them are had recourſe to; and by theſe preparations may be ſhewn,

1. The fibrous texture of bones, and the pliancy and flexibility to which they can be reduced.

2. The vaſcularity of bones, and

3. Their internal cancellated appearance.

14. To ſhew the fibrous texture of bones, let a bone be immerſed in a weak acid liquor made of an ounce of muriatic acid, and one quart of water in a glaſs veſſel, in which ſolution it muſt lie from three to four months. By the end of this ſolution, the earth of the bone will be neutralized, and in time ſeparated from the fibrous part. To be ſucceſsful, much time muſt be given for completing the proceſs; and the acid occaſionally added to the liquor, which ſhould never be too ſtrong. In this ſtate, the bones become perfectly flexible.

15. The vaſcularity of bones is ſhewn by the ſame proceſs; but, in order to do it, not a ſingle bone, but the whole extremity muſt be taken; and, when

thoroughly heated by immerſing it in hot water, it is to be injected by the arteries; and on finiſhing this part, the bone may be ſubmitted to the former proceſs.

16. To demonſtrate the cancelli of bones, the middle part of the os femoris ſhould be cut into portions of two inches in length, by means of a fine ſaw, ſteadily uſed. Theſe pieces ſhould be ſubmitted to maceration in water for two or three months, to remove all their medullary oil; and, when dried, the reticulated ſtructure of the cancelli will appear diſtributed through the cavity. Recent bones anſwer here beſt.

Preparation of the Perioſteum.

The ſtructure of the perioſteum is ſhewn by taking part of it from an injected ſubject, which muſt be laid in water, and the water ſhould be changed every day while any bloody tinge appears. When removed from the water, it may be either preſerved in its wet ſtate in a veſſel with ſpirits of wine, or it may be dried, and placed in oil of turpentine, or preſerved by varniſh.

PART II.

DEMONSTRATION AND DISSECTION.

CCXVII.

HAVING now demonſtrated at ſufficient length the ſtructure of the bones, or the baſis of the body; we proceed next to what we have termed Demonſtration and Diſſection, or to view the machine in its natural ſtate, beginning our inveſtigation with the ſurface, and extending our view internally, as the parts become unfolded by the knife.

CCXVIII.

Common Teguments.

The firſt part that arreſts our attention on this plan, is the common teguments, which conſiſt of three parts, the cuticle or epidermis, the rete mucoſum, and true ſkin.

CCXIX.

Cuticle (Epidermis).

The epidermis, or ſcarf ſkin, is a thin, almoſt tranſparent, and inſenſible membrane. It is eaſily ſeparated from the parts below by maceration, putrefaction, or the application of a bliſter. It varies in its thickneſs in different places, both originally as we find in the fœtus, and alſo farther in conſequence of preſſure in the courſe of life. When minutely examined, it is compoſed of layers or laminæ, which are more diſtinctly ſeparable from its greater thickneſs in the negro than in the white ſubject. Its external ſurface is alſo marked by furrows correſponding to thoſe of the true ſkin, by which its ſhape is adjuſted; and it is diſtinguiſhed by numerous perforations. 1*ſt*, From the exhalant veſſels which throw out the perſpiration or ſweat. 2*dly*, From the extremities of excretory ducts, which appear only in particular parts of it. 3*dly*, From the openings of abſorbents, which take up whatever is applied to the ſurface: and 4*thly*, From the holes for tranſmiſſion of hairs, which are very numerous over it.

The firſt, however, or what are termed the pores of the ſkin, are moſt conſpicuous upon the palms and ſoles, and alſo upon the noſe, ears, and penis.

CCXX.

The cuticle, or external covering, pervades every part of the ſurface except under the nails. It is reflected alſo inwards, to line the principal paſſages, particularly the alimentary canal, trachea, &c.; and in theſe ſituations it becomes ſomewhat changed in its texture. Certain proceſſes alſo, where it forms the lining of paſſages, connect it with the ſkin.

CCXXI.

On the formation of this part, various opinions have been formed by authors, the moſt probable of which is, that it is produced by a condenſation of the next part, or corpus mucoſum, or elſe by the extremities of excretory veſſels. Such is its denſity, that no veſſels can be traced in it.

CCXXII.

The functions of the cuticle are various. It protects the ſenſible parts below from external irritation. It regulates the proportion of fluids received into and expended by the ſurface, and thus it hinders that degree of evaporation that would prove hurtful.

CCXXIII.

Rete Mucoſum.

The ſecond part of the teguments, on removing the cuticle that comes into view, is what is termed the rete mucoſum, ſo named from its ſuppoſed reſemblance to a net work. This part is compoſed of the extremities of ſmall veſſels paſſing between the cuticle and true ſkin, but involved in or ſurrounded by a viſcid ſubſtance. This ſubſtance is extremely thin, and ſeparated with difficulty in the European, but it is thicker and ſofter, conſequently eaſily inveſtigated in the negro, in whom it can even be divided into two diſtinct layers. Its texture however is ſo ſoft, that it ſuffers a complete ſolution by maceration in water.

CCXXIV.

It is to this part, the variety of colour conſpicuous in the natives of different climates, and alſo in individuals of the ſame climate, is chiefly to be referred. Thus it is of a white, or rather light grey ſemi-tranſparent colour in the European, black in the Ethiopian, and brown in the Aſiatic, and its ſhades vary more or leſs in almoſt every individual.

CCXXV.

Like the cuticle, this part pervades the whole extent of the ſurface except the nails, and it is alſo marked by the ridges of the cutis vera. Its colour is ſomewhat lighter in the palms and ſoles than elſewhere.

CCXXVI.

The functions of this part are not wholly determined. It clearly ſerves as a cuſhion or defence to the ſmall cuticular veſſels, and in the warmer climates probably hinders alſo the too great penetration of the ſolar heat.

CCXXVII.

True Skin (*Cutis Vera*).

The true ſkin, the laſt and principal diviſion of the teguments, gives a general covering to the whole body. It is formed of fibres cloſely compacted together, and ſo interwoven, as to run in every direction. It is plentiſully ſupplied with blood-veſſels and nerves, ſo that the ſmalleſt puncture gives pain and draws blood. Such is the number and ſize of its veſſels, that the ſkin can be readily injected. In its texture it is ſtrong, elaſtic, and capable of conſiderable elongation; and from theſe qualities in quadrupeds, it is converted into leather. Its ſtrength and denſity, however, is greater externally than internally; and it is alſo thicker and looſer on the poſterior than on the anterior parts of the body, and thickeſt and ſtrongeſt on the palms and ſoles, than on any of the extreme parts.

CCXXVIII.

From the different proportions of its circulation, the colour of this part differs in different parts of the body, and the thinneſs of the cuticle produces alſo the ſame effect as at the edge of the eye-lids, the red or vermilion part of the lips, &c.

CCXXIX.

In examining the ſtructure of this part on removing the former diviſions, it ſeems every where beſet with innumerable papillæ or eminences, which appear like minute granulations. In theſe papillæ is ſuppoſed to reſide the organ of touch, from their extreme ſenſibility and vaſcularity.

Their appearance differs ſomewhat in different parts of the ſkin, as on the inſide of the lips, where they are termed villi. They are moſt conſpicuous on the palms and ſoles, where they appear placed in double rows upon the ridges running on the points of the toes and fingers in a ſomewhat ſpiral and parallel direction, and by theſe ridges they are both defended, and the perſpirable ſurface increaſed. Beſides this general ſtructure, various folds are obſerved in the ſkin, which depend on the particular form and texture of the more internal parts; and where theſe folds exiſt, the ſkin is thinner than elſewhere, to allow a pliancy and eaſe of motion.

CCXXX.

From this account of its ſtructure, the uſes of the ſkin are to give form to the body. to unite the different parts of it, and to defend them from injury. Beſides which, it forms the external organ of ſenſation, and gives paſſage to the various fluids abſorbed or perſpired; but in order that it may execute theſe functions properly, it is preſerved moiſt by the rete mucoſum, and it is guarded from external injury by the cuticle, and alſo has the exceſs of its ſenſibility taken off or diminiſhed.

CCXXXI.

After this general view of the form of the ſkin, we are next led to examine what have been termed its appendages, the firſt of which is the nails.

CCXXXII.

Nails.

The nails are proved a continuation of the cuticle by their ſeparating along with it by boiling water or maceration, by their ſimilar inſenſibility and apparent want of veſſels, and by their being renewed when removed. They are compoſed of different layers applied over each other, formed of longitudinal fibres, but of unequal ſize. In their dead ſtate, when detached from the body, they are entirely tranſparent; but they receive circulation and colour in their natural ſituation from the veſſels of the ſkin to which they adhere. Their origin is by a ſquare root a little before the laſt joint of the fingers and toes, and they are fixed at their roots by a ſemi-lunar fold of the cutis, over which is reflected at this part, the covering of the cuticle adhering to them. Their growth takes place from their roots, not from their points.

CCXXXIII.

The uſe of the nails is to defend from injury the extremities of the fingers and toes, to increaſe their powers of apprehenſion, and eſpecially to render minute objects more eaſily taken hold of.

CCXXXIV.

Hairs.

Next to the nails, as an appendage to the ſkin, fall to be examined the hairs. The appearance and colour of the hairs, differ both in different parts of the ſame body, and they differ alſo in different individuals. They ariſe by roots or bulbs, which have their ſeat in the cellular ſubſtance under the ſkin. Theſe bulbs are of various ſhape in different parts of the body, and are furniſhed with blood-veſſels diſperſed upon them for their nouriſhment.

CCXXXV.

Each bulb is diviſible into two membranes or capſules, within which is an oily fluid, ſuppoſed to give colour to the hair; by want of which from age, or under diſeaſe, it becomes white. The body of the hair, or outer part, conſiſts of ſmaller hairs incloſed in a membrane; and they vary in ſoftneſs and colour, according to climate, age, and conſtitution. The growth of the hair, like that of the nails, is from the root.

CCXXXVI.

Though ornament and warmth may be conſidered as one uſe of the hair; yet it is certainly intended by nature for other important purpoſes with which we are ſtill unacquainted.

CCXXXVII.

Sebaceous Follicles.

In parts of the ſurface expoſed to air or friction, the ſkin poſſeſſes a particular appendage, or ſecretory organs, termed the ſebaceous ducts or follicles. Theſe contain an unctuous matter, which can be ſqueezed out, being often of a firm conſiſtence, and reſembling a ſmall worm. The ſeat of theſe ducts is under the ſkin, and they are moſt conſpicuous in the noſe, ears, nipples, groins, and external parts of generation.

Their uſe is evidently by means of their fluid, to lubricate and defend from irritation.

CCXXXVIII.

Miliary Glands.

In the ſame manner in the arm-pits, we find what are termed miliary glands, from their reſemblance to millet ſeeds. This ſtructure has been conſidered as general over the ſkin, though it does not bear demonſtration from its minuteneſs.

CCXXXIX.

Cellular Membrane (Membrana Cellularis).

But a more important part, and which forms a ſtill more general covering than the ſkin itſelf, is the next diviſion of the animal ſtructure that appears on diſſection, or what is termed the cellular membrane. It inveſts every part of the body, the moſt minute we are able to trace. It is compoſed of a fine web, formed of many membranes connected together in an irregular manner, and made up of cells which communicate freely with each other wherever they are found, a conſpicuous proof of which is afforded in diſeaſe.

In its natural ſtate it is highly elaſtic; and, if drawn out to any extent, it ſuddenly recoils, which ſhews its ſtructure highly condenſed and compacted.

CCXL.

The extent of this membrane is greater than that of any other part. It firſt lines the ſkin; it next covers the muſcles; it then enters between their fibres; and laſtly, it forms part of their compoſition. It varies, however, in its thickneſs in different parts of the body, eſpecially where there is much expoſure to preſſure; as in the hips, palms, and ſoles, and there it is always thickeſt.

CCXLI.

The cells of this membrane are kept moiſt by an interſtitial fluid, and in many parts they ſuſtain the fat, or the veſicles containing it are depoſited in them. On the whole, it poſſeſſes little ſhare of ſenſibility, and diſcovers on injury little irritability or pain. Its chief uſe ſeems to be to connect parts together to prevent their morbid adheſion to each other, to form their covering and ſheath to move in, and to ſerve as a depoſition for the organs ſecreting the fat.

CXLII.

Fat (Adeps).

The opening of the cellular membrane leads next to the examination of the fat. This ſubſtance is lodged in it, but without any proper communication with it. It is made up of maſſes compoſed of ſmall veſicles containing it. Theſe veſicles are ſurrounded by a network of blood veſſels which ſecrete the fat, without any glandular ſtructure; and this fat tranſudes from the cells without any communication between the veſicles with each other, or with the excretory ducts to convey it.

CCXLIII.

The fat ſhews conſiderable difference in its conſiſtence in different parts of the body. In the living animal it is generally fluid, though in ſome parts it is more ſolid, and in the ſame ſtate as it diſplays after death. The fullneſs and ſize of the body are in a proportion to the preſence of the fat; and it is depoſited in almoſt every part of the ſyſtem, external as well as internal: but in young perſons it is for the moſt part placed externally, while in the aged it is removed to the internal parts, and depoſited on the viſcera.

CCXLIV.

The uſes of the fat are numerous. It particularly ſerves to lubricate every part; to facilitate the action of the muſcles; to give form, ſmoothneſs, and plumpneſs, when required; to obviate the effects of preſſure; and to be ready as a reſervoir of nouriſhment, when needed under diſeaſe.

Chemical Analyſis of the Common Teguments and their Appendages.

1. The cuticle, when ſubmitted to chemical inveſtigation, is chiefly compoſed of gelatin. The rete mucoſum in its conſiſtence is glutinous, and without taſte or ſmell. In colour it varies from the three cauſes of climate, part of the body, and diſeaſe. The firſt was already noticed in its deſcription. The ſecond is conſpicuous in the areolæ of the nipples; and the third in jaundice, chloroſis, and other diſeaſes. The conſtituent principles of this part are animal mucus, mixt with the colouring principle.

2. The true ſkin, in conſequence of the different experiments of chemiſts, is found to be ſimply gelatin, with an additional quantity of oxygen.

3. The nails, when boiled, give out jelly and a ſmall portion of oil, but they contain no earth, ſome gluten, and a little phoſphorated calx.

4. The hairs give out the ſame principles as the nails, animal jelly, and a ſmall portion of oil without any earth.

5. The ſebaceous follicles and miliary glands, are moſt re[illegible]rkable for their ſecretion, which is ſomewhat oleaginous, and moſt conſpicuous under the arm-pit. It is of a pale colour, reddiſh in the axillæ, and blackiſh between the toes. It ſtains the clothes frequently of a blue colour, and is converted into a red by the juice of lemons.

6. The fat is fluid in the living body, has a hard, ſoft, and oleous taſte. Though in various proportions, it is never leſs at a medium than 8lbs. in one perſon;

but from mode of life and conſtitution, it is often accumulated to an enormous degree. Its conſtituent principles are oil chemically combined with ſebacic acid, and the elements of this laſt are, oxygen, united with an unknown acidifiable baſe.

Anatomical Preparation of Teguments.

7. The ſkin is prepared in the ſame manner as the perioſteum of the bones, and may be formed either into a wet or dry preparation. When put into water, it ſhould remain in maceration till the cuticle peel eaſily off; by the removal of which, its vaſcularity will be beautifully exhibited.

CCXLV.

The Muſcles.

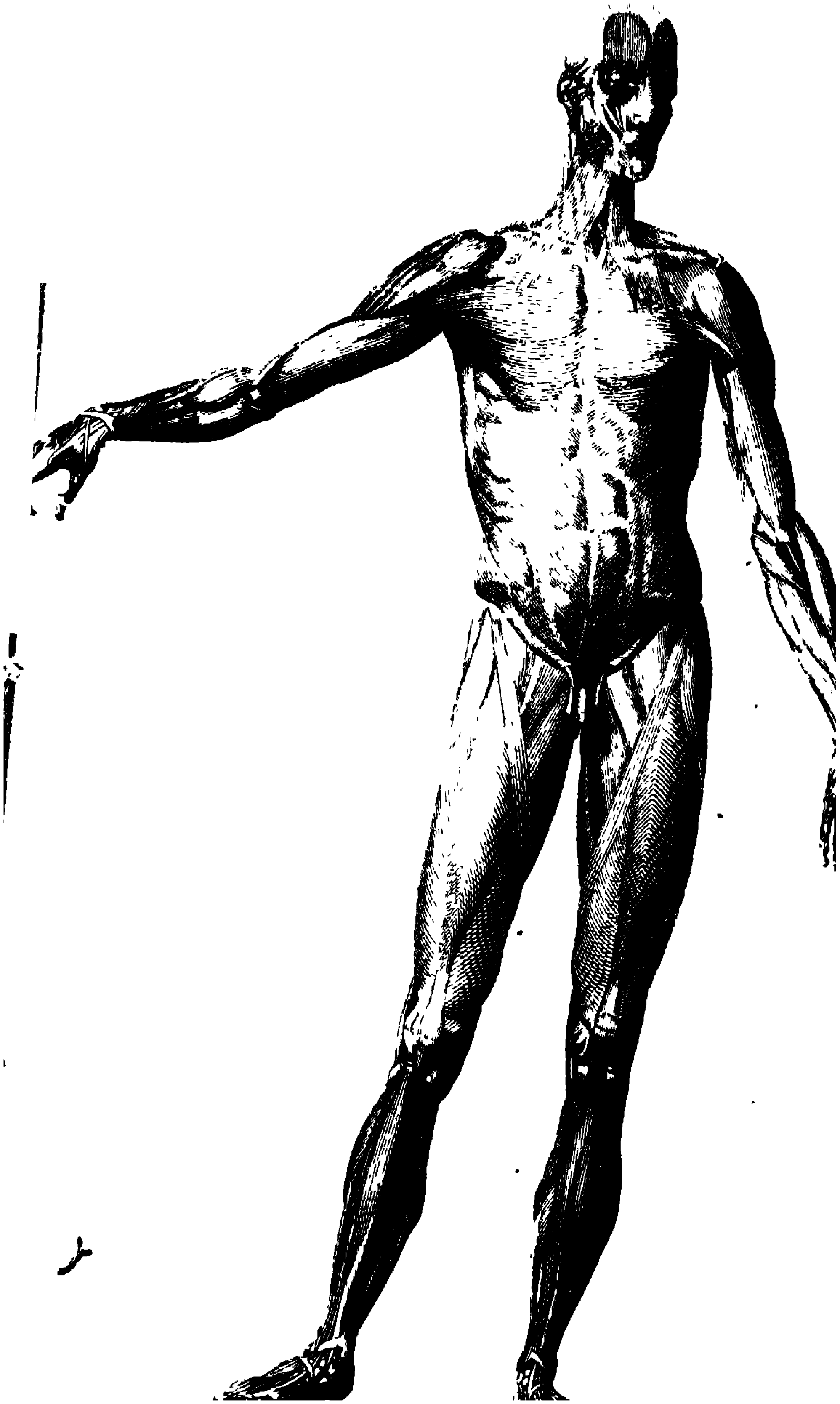
On removing the ſkin and adipous membrane, the muſcles come into view, or the organs by which the motions of the animal machine are produced.

CCXLVI.

Theſe motions depend on a certain inherent power of the muſcular fibre peculiar to itſelf, and which gives it the diſtinguiſhing character of contractility.

CCXLVII.

To explain this power, various attempts have been made by anatomiſts; ſome conceiving it to depend on the ſize, others on the form of the muſcular fibre; but theſe explanations proving ſtill unſatisfactory, reaſon has drawn us to this ultimate and more juſt concluſion, that it is a



power originally attached to the muſcular fibre, and connected alone with this form of organization, in a manner not to be aſcertained. Its exiſtence, therefore, as the ſource of motion and life, we have only to trace.

CCXLVIII.

This exiſtence we are to conſider as confined entirely to the muſcle itſelf, and as no way conveyed from it to the ſenſorium; that it is the power by which the muſcles themſelves feel and react, without any connection or communication with the reſt of the ſyſtem.

CCXLIX.

To this power, the name of irritability has been aſſigned, and in proof of its independence, it is ſeen to exiſt when muſcles are ſeparated from every other part of the body, and when the latter is to all appearance dead. The ſeparation therefore of the nerves of a muſcle no way affects its contractility. Its contractility is no way connected with its feeling, and can be put in action when its feeling is entirely gone. Thus the power of muſcles ſurvives life, while feeling terminates with life, and it alſo ſurvives connexion with the reſt of the body:—facts, which ſtrongly mark it as a peculiar and independent property of this form of organization.

CCL.

By this power, the parts are preſerved ready for the action of ſuch ſtimuli as may be applied to them; and, while the nerves convey the impreſſion, the muſcles contain the power by which this impreſſion is put into effect. The nervous energy becomes exhauſted or diminiſhed; but the power of the muſcles remains always the ſame, and ſuffers no decay. Senſibility then is dependent on the nerves and motion on the muſcles.

CCLI.

The power of the muſcles alſo requires no need of mechanical aid in the performance of its motions; for they can be exerted in a degree ſuited to the force or energy, which the actions of the body require. Hence, the mechanical aid ariſing from the form or conſtruction of muſcles, is never to be taken into account; for the form of different parts of the body is generally in oppoſition to this circumſtance, and yet the power of the muſcle is ſufficient to perform the particular function aſſigned it.

CCLII.

In the conſtruction of the human ſyſtem, the vital energy predominates an energy no way ſubjected to the laws of inanimate matter; but which muſt be conſidered as a peculiar agent, whoſe operation regulates every part of the ſyſtem in which it is implanted; and which is modified according to the nature of each parttcular part, or the purpoſes for which it is intended.

CCLIII.

The muſcles being intended for motion, this modification of the vital principle they receive, is termed, as already noticed, their irritability. They are compoſed of fleſhy fibres or threads in which it reſides, and each muſcle is divided into a body and two extremities. The extremities are generally formed into a firm, gliſtening, and inſenſible ſubſtance of a white colour; when round and ſlender, named tendon, and aponeurofis, when broad, flat, and expanded. By this change of ſtructure, the muſcle is condenſed into leſs form, and thus room is given for its complete attachment to the fixed parts that receive it. Theſe extremities of a muſcle are diſtinguiſhed into its head or origin, and its tail or inſertion, though this diſtinction is not always properly made. The firſt is conſidered as the fixed or immoveable point, the ſecond as the looſe one, to the alteration or movement of which the action of the muſcle tends. To allow again the general body or belly of the muſcle to play with eaſe, there is a thick coat over it of cellular ſubſtance, which condenſed, gives the appearance of what has been termed the proper membrane or coat of the muſcles; (*Membrana Propria Muſculorum;*) and, as every fibre of the muſcle is active, and as the fibres are not only ſwelled out, but they are thrown into a zig zag form; to allow of this action, the cellular ſubſtance dips in between all the fibres of our body.

CCLIV.

The action of every muſcle depends on the length of its fibre, and the extent of its motion correſponds to this. Various have been the opinions on the ſtructure of theſe fibres. We find them by the eye diſpoſed in faſciculi or bundles, and theſe ſubdivided into ſmaller ones; but farther we cannot go in our reſearch into their intimate ſtructure, neither is it of any importance.

CCLV.

Many arrangements of the muſcles have been made by authors. The ſimpleſt and eaſieſt is that which demonſtrates them according to their ſituation, beginning in the order of the oſteology, and conſidering them as cords attached to the bones to effect their movement. On this plan we firſt demonſtrate the

CCLVI.

MUSCLES OF THE HEAD.

1. *Occipito Frontalis.*

The 1*ſt* that falls to be deſcribed, and which covers the upper part of the head with a broad thin expanſion, is named the occipito frontalis, having two bellies divided by intermediate tendon, firmly attached to the ſkin; ſo that the one belly is ſpread over the forehead, and the other over the hindhead. This diviſion has cauſed it to be miſtaken for two ſeparate muſcles, and its tendon for part of the pericranium. In demonſtrating it particularly, we obſerve,

1. The origin or fixt point of this muſcle is placed at the upper ridge of the occipital bone, covering all the back part of the head from the maſtoid proceſs on one ſide, to the ſame place on the other.

2. The inſertion of this muſcle is into the ſkin and eyebrows, after covering by its frontal belly the forehead. It poſſeſſes alſo ſome ſlight attachment to the bone at the orbitary ridge, inner corner of the eye, and root of the noſe.

3. The uſe of this muſcle is to move all that part of the ſkin which covers it, conſequently to raiſe the eyebrows, wrinkle the forehead, &c. Thus it is a muſcle chiefly employed in expreſſing the paſſions, and in many ſubjects it is entirely wanting.

4. Its naſal ſlip, or continuation on the noſe, being inſerted into the naſal bone, muſt ſerve to pull the eyebrow downwards, or to antagonize the other parts of the muſcle.

CCLVII.

2. *Corrugator Supercilii.*

The corrugator ſupercilii is a ſmall muſcle or ſlip, which, though connected ſomewhat with the occipito frontalis, is generally deſcribed ſeparate. It ariſes from the internal angular proceſs of the frontal bone, its fibres ſweep round the edge of the orbit, and in their progreſs become mixed with thoſe of the frontal and orbicular muſcles, being inſerted where theſe two join each other, or into the eyebrow. Thus, by its action, it aſſiſts in drawing the eyebrows together, and in corrugating or wrinkling the ſkin between them into longitudinal folds.

CCLVIII.

3. *Orbicularis Oculi* or *Palpebrarum.*

The orbicularis oculi is a muſcle that ſurrounds the eyelids in a circular form, of a flat thin appearance, and about an inch in breadth. Its ſituation is immediately under the ſkin of the eyelid, to which it is more connected than to the bone. Its origin is from the orbitar proceſs of the ſuperior maxillary bone, from the internal angular proceſs of the frontal bone, and by a ſmall round tendon from the naſal proceſs of the ſuperior maxillary bone, which tendon is eaſily felt through the ſkin, in the inner corner of the eye externally; the ſurface of the muſcle adheres to the eyelids, and on its upper and inner edge, it is connected with the frontal and corrugator muſcles. It forms in its whole courſe a thin muſcular expanſion, varying in its breadth at different places; and where its fibres croſs each other from the upper and lower part, it has been divided into two muſcles, that part which is next to the cartilaginous circle of the eyelids being named the ciliary muſcle. The action of this muſcle from its circular form, is to bring the eyelids together, to preſs the ball inwards, which it does even with violence in caſes of injury, and to force the lacrymal gland within the ſocket to a diſcharge of tears.

CCLIX.

4. *Levator Palpebræ Superioris.*

This ſmall muſcle ariſes from the hole which gives paſſage to the optic nerve. In its courſe it runs forward within the orbit over the levator oculi, beginning by a ſmall flat tendon in the bottom of the optic cavity, and expanding as it proceeds over the eyeball, till it terminates in the lid.

CCLX.

Thus, in commenting on the muſcles deſcribed, we obſerve that the occipito frontalis raiſes the eyebrows, which are again pulled down by its pointed ſlip. That the corrugator draws them directly inwards; and, that it alſo knits the brow, while the levator opens the eye, which is again fully cloſed by the orbicular muſcle.

CCLXI.

MUSCLES OF THE NOSE AND MOUTH.

5. *Levator Labii Superioris et Alæ Naſi.*

This muſcle ariſes by two thin ſlips, or a double tendon from the naſal proceſs of the upper jaw-bone. In its progreſs it divides into two parts, one of which is inſerted into the cartilaginous wing of the noſe, and the other paſſes on to the upper lip. Its action is to raiſe the upper lip, and draw it and the ſkin of the noſe upwards and outwards. Thus it ſerves to dilate the noſtril.

CCLXII.

6. *Levator Labii Inferioris Proprius.*

This muſcle is termed alſo the inciſivus, in conſequence of its origin from the upper jaw, immediately above the inciſors or cutting teeth, where it is broad. Its progreſs downwards is oblique and inwards, terminating in the middle of the lip. Its action is to pull the lip and ſeptum of the noſe upwards.

CCLXIII.

7. *Levator Anguli Oris.*

This muſcle, termed alſo caninus, ariſes immediately under the ſuperior maxillary bone, between the orbitar hole and the firſt molar tooth. It is inſerted into the orbicular muſcle of the mouth at its angle, and its action is to raiſe the corner of the mouth, as in expreſſing the chearful paſſions.

CCLXIV.

8. *Zygomaticus Major.*

This muſcle agrees with the former, both in its direction and uſe. Its origin is the cheek-bone near the zygomatic ſuture, whence it deſcends obliquely forwards, till inſerted in the angle of the mouth. Its action is to inflate the cheek, and raiſe the angle of the mouth. Its fibres are intermixed with thoſe of the orbicularis of the mouth, and the depreſſor of the lip.

CCLXV.

9. *Zygomaticus Minor.*

In its origin, this muſcle is nearer the noſe, and is more ſlender than the former. It is inſerted alſo into the angle of the mouth, and its action is to raiſe it obliquely outwards.

CCLXVI.

By the zygomatic muſcle, is that line formed which is ſo conſpicuous in many, and extends from the cheek-bone to the corner of the mouth. To pull the corners of the mouth upwards is its action; and thus, from occaſioning diſtortion of this part, it is employed in expreſſing ſeveral paſſions, as laughter, rage, grinning.

CCLXVII.

10. *Buccinator.*

The trumpet muſcle is of ſuch a ſize, as to form the walls of the cheek. It ariſes from the ſockets of the molar teeth in both jaws, and it advances with direct fibres to be inſerted into the corner of the mouth, along with the orbicularis. This muſcle is perforated in the middle by the duct of the parotid gland. Its uſes are to draw the angle of the mouth backwards and outwards; and to contract its cavity by preſſing the cheek inwards. Thus it aſſiſts in ſwallowing, particularly liquids. It prevents alſo the food in the mouth from getting beyond the line of the teeth in manducation. In the blowing of wind inſtruments it is active, and has therefore received its name from blowing the trumpet.

CCLXVIII.

11. *Depreſſor Anguli Oris.*

This is a triangular muſcle at the ſide of the chin, ariſing from the lower edge of the inferior jaw-bone, where its baſe is placed. It paſſes on with a flat fleſhy head, an inch in breadth; and is inſerted into the angle of the mouth, intermixing with the levator anguli oris. Its action is chiefly employed in expreſſing the paſſions, and in giving form to the chin and mouth. In the angry paſſions it depreſſes the corner of the mouth.

CCLXIX.

12. *Depreſſor Labii Inferioris.*

This is a ſmall ſquare muſcle, ſituated on each ſide of the chin, and ariſing from the lower and anterior edge of the maxilla inferior. It paſſes obliquely upwards and inwards, and is inſerted into the under lip. Its action is to draw the under lip downwards, and ſomewhat outwards.

CCLXX.

13. *Orbicularis Oris*

Is a regular muſcle, forming the ſphincter of the mouth, and in breadth conſtituting the thickneſs of the lips. From its croſſing at the angles of the mouth, it has been conſidered often as two ſemi-circular muſcles, in the ſame manner as the orbicularis of the eye. Its fixed points are the angles of the mouth, and its action is to contract or ſhut the mouth, and to antagonize the other muſcles deſcribed. A ſmall ſlip often runs up from it, from the middle of the upper lip to the tip of the noſe; ſerving as a levator of the former, and depreſſor of the latter.

CCLXXI.

The offices which the muſcles of the noſe and lips perform, are various and important. They are acceſſary to the performance of the great functions of breathing, ſpeaking, and the other offices of the mouth; and they likewiſe ſerve to expreſs the different paſſions. Thus, in attending to their ſeparate operation, we obſerve that the levator labii ſuperioris, and the depreſſor labii inferioris, by ſeparating the lips, open the mouth; while the levator anguli oris, and the zygomatic muſcles raiſe the cheeks, and dilate the corners of the mouth. The buccinnator opens the mouth in conſequence of drawing it directly backwards.

The angularis oris pulls the angles of the mouth downwards and backwards; thus ſorming it into a circle, and dilating it. But all theſe muſcles are oppoſed by the orbicularis, which ſhuts the mouth, and that ſo completely, as to retain the breath againſt every exertion. Underneath the muſcles demonſtrated, ſome ſmaller ones ſtill remain proper to theſe parts.

The *1ſt* of them is

CCLXXII.

14. *Depreſſor Labii Superioris et Alæ Naſi,*

A ſmall fleſhy muſcle, which ariſes from the gum or ſocket of the fore teeth of the upper jaw, and is inſerted into the upper lip and root of the ala naſi. Its action is to pull the upper lip down.

CCLXXIII.

15. *Conſtrictor Naſi*

Is a ſcattered bundle of muſcular fibres, which croſſes the wings, and goes to the point of the noſe. It is fixed with its fellow in the middle cartilage or lower point of the naſal bones. Its uſe is to preſs the ala, as in ſmelling, towards the ſeptum. It alſo corrugates the ſkin of the noſe.

CCLXXIV.

16. *Levator Menti.*

This muſcle ariſes at the root of the cutting teeth, and is inſerted into the ſkin on the very centre of the chin. By its action, the ſkin is drawn into a dimple, and it ſtretches the under lip at the ſame time.

CCLXXV.

Muſcles of the Ear.

The external ear poſſeſſes rarely any motion in the human ſubject, in which it differs from animals. A ſlight degree of motion, however, has been obſerved in ſome particular inſtances. The muſcles which belong to this organ are numerous.

CCLXXVI.

17. *Superior Auris.*

The firſt is the attollens aurem, ſo termed from its action in raiſing the ear. It is a thin flat expanſion, covering the aponeuroſis of the temporal muſcle; from its origin it becomes gradually narrower to its inſertion in the root of the cartilage of the ear. It is, perhaps, more intended to give tenſion to the part to which it is united, than to raiſe the ear.

CCLXXVII.

18. *Anterior Auris*

Is a thin membranous expanſion near the poſterior part of the zygoma, which is inſerted near the cartilaginous tube, at its root. Its uſe is to ſtretch this part of the ear to which it is fixed.

CCLXXVIII.

19. *Poſterior Auris*

Is a ſmall delicate muſcle, which ariſes in three narrow ſlips from the ſituation of the maſtoid proceſs; and paſſing forwards, they are inſerted directly into the bony part of the concha. By their action, this part is ſtretched; and the ear in ſome perſons alſo drawn back, on which account it is frequently named the retrahens auris.

After theſe external muſcles, follow in their order the muſcles proper to the ear itſelf, which are:

CCLXXIX.

20. *Muſculus Helicis Major.*

This muſcle lies upon the upper and ſharp point of the outward ring; and its action is to pull that part into which it is inſerted, downwards and forwards.

CCLXXX.

21. *Muſculus Helicis Minor.*

This is placed alſo upon the helix, but lower in its ſituation.

CCLXXXI.

22. *Muſculus Tragicus.*

This muſcle lies upon the concha, and ſtretches to the tragus; the point of which falls a little forwards.

CCLXXXII.

23. *Muſculus Antitragicus.*

This muſcle is ſituated in the antitragus, and is meant to turn the tip of the antitragus a little outwards.

CCLXXXIII.

24. *Tranſverſus.*

This laſt muſcle ariſes from the prominent part of the concha, and is inſerted into the outſide of the antihelix. Its uſe is to draw the parts to which it is connected towards each other.

CCLXXXIV.

Muſcles of the Eye Ball.

The ball of the eye, is neceſſarily ſurrounded from its function with muſcles, ſo that it may be eaſily moved in every direction. Theſe muſcles are divided according to their direction into four ſtraight, and two oblique muſcles. They ariſe very deep from the bottom of the ſocket. They are expanded on the ball of the eye, and fixed or united to its forepart in the form of colourleſs tendons ſpread out, ſo as to form the white of the eye. The ſtraight muſcles are ſituated one above, one below, and one on each ſide; and their action is to pull from the bottom of the ſocket. The oblique muſcles again act, by pulling from the edges of the ſocket, and turn the eye directly the reverſe of the ſtraight muſcles. The ſtraight muſcles are not juſt what the name implies, as on account of the ſituation of the eye and the ſhape of the orbit, they do not run in a ſtraight direction. Neither are they all equally long, the internal being the ſhorteſt, the external the longeſt, and the other two nearly of the ſame length. They all agree in this, that they ariſe by a ſmall narrow beginning, tendinous and fleſhy from the edge of the optic hole, where they ſurround the nerve completely, and adhere to it. In their progreſs they gradually expand into a fleſhy belly, which ſends off broad and very thin tendons to be inſerted into a ſeparate coat; and thus they form the white of the eye. In their coruſe alſo, they are covered with a cellular ſheath, which comes to terminate in that covering that is interpoſed between the ſclerotica and conjunctiva.

CCLXXXV.

25. *Rectus Superior.*

The *1ſt* of the ſtraight muſcles is the rectus ſuperior, termed alſo the attollens, the levator oculi, and ſuperbus. The two firſt, from its uſe to raiſe the forepart of the ball of the eye; the laſt, from its being employed to expreſs haughtineſs and pride.

CCLXXXVI.

26. *Rectus Inferior.*

This muſcle is the oppoſite of the former, and is therefore termed the depreſſor oculi or humilis, as expreſſive of modeſty and ſubmiſſion, by pulling the eye downwards.

CCLXXXVII.

27. *Rectus Internus.*

The action of this muſcle is to turn the forepart of the eye towards the noſe. Hence it is termed adducens, and alſo bitorius, from its carrying the eye towards the cup.

CCLXXXVIII.

28. *Rectus Externus.*

This muſcle directs the eye towards the temple, or turns it away as in anger and ſcorn; therefore named the abducens and indignabundus.

By the ſucceſſive action of theſe muſcles deſcribed, the eye comes to be rolled. Acting again, at once they immoveably fix it.

From the ſtraight, we come next to the conſideration of the oblique muſcles.

CCLXXXIX.

29. *Obliquus Superior.*

The firſt of them, the obliquus ſuperior, like the ſtraight muſcles, ariſes from the edge of the optic hole on the inner ſide; and running ſtraight forward, ſends off a long round tendon which paſſes through a cartilaginous pulley, fixed behind the internal angular proceſs of the frontal bone. This pulley projects farther than the moſt prominent part of the eye ball; and the tendon is inſerted into the ſclerotic coat, half way between the inſertion of the levator oculi, and entrance of the optic nerve. The action of this muſcle is, to turn the pupil of the eye downwards and outwards.

CCXC.

30. *Obliquas Inferior.*

This muſcle ariſes from the naſal proceſs of the jaw-bone in the lower edge of the orbit at the inner corner of the eye; from which it paſſes obliquely outwards, backwards, and upwards, round the ball of the eye. It is inſerted by a broad thin tendon into the ſclerotic coat, oppoſite to the inſertion of the ſuperior one; and its uſe is to turn the eye upwards and inwards.

CCXCI.

Theſe oblique muſcles, from their action in rolling the eye, have been named rotatores and amatorii. They bring the eye ball forward in the ſocket when their action is conjoined. When ſeparate, the upper oblique rolls the eye ſo as to turn the pupil downwards towards the noſe; while the lower oblique reverſes this, and directs it upwards and outwards.

CCXCII.

Muſcles of the Lower Jaw.

Having demonſtrated the muſcles of the head, face, ear, and eye, we proceed to thoſe of the lower jaw, they are of great power, which they neceſſarily require in the manducation of the food.

CCXCIII.

31. *Temporal Muſcle.*

The firſt of theſe muſcles is the temporal one, which ariſes in that hollow behind the eye, from all the bones which have a ſhare in forming the ſquamous ſuture. It ariſes alſo from the ſtrong membrane extended from the jugum to the ſemicircular ridge of the parietal bone. Its fibres deſcend like radii, and it changes into tendon as it paſſes under the jugum, till it is inſerted into the coronoid proceſs of the lower jaw, which it encloſes. By its action it pulls the jaw upwards and backwards.

CCXCIV.

32. *Maſſeter.*

The rounding of the cheek, at its back part, is formed by this thick fleſhy muſcle, which ariſes from the ſuperior maxillary bone, where it joins the os malæ, and from the whole length of the inner and under edge of the zygoma. It lies in the outſide of the coronoid proceſs, covering the branch of the jaw quite down to its angle. The parotid gland lies in its upper part, and its duct lies over this muſcle as it croſſes the cheek. With the former muſcle it pulls up the jaw.

CCXCV.

33. *Pterygoid Muſcles.*

The two pterygoid muſcles on each ſide, are ſo named from the pterygoid proceſs of the ſphenoid bone, from which they ariſe. The internal one is that one which ariſes from the internal pterygoid proceſs, and which paſſes to the angle of the jaw on its inſide. The external one ariſes from the external proceſs, and goes directly outwards, being inſerted high up in the jaw bone. The action of the firſt is to raiſe the jaw, and draw it obliquely towards the oppoſite ſide. The action of the ſecond is to pull the jaw from ſide to ſide.

CCXCVI.

Thus, in attending to the motion of the lower jaw, we find that the temporal muſcle acts like a lever upon the coronoid proceſs; the maſſeter does the ſame upon the angle, while the internal pterygoid balances the maſſeter within, and the jaw is by this means pulled ſtrongly upwards for its different offices. The internal pterygoid draws it again from ſide to ſide, or produces that rotation which is eſſential for the purpoſes of chewing and grinding.

CCXCVII.

In conſidering the muſcles of the face, we obſerve that thoſe of the lips perform a double office; for, beſides their common motions, they ſerve likewiſe to explain to one another our intentions, or expreſs our paſſions in a manner readily underſtood, but difficult to be deſcribed; and that ariſing from original texture. As a proof of this, we find in children the expreſſion very much varied, and that this variety is by no means to be attributed to habit. Indeed, the diſpoſition of the muſcular fibres would ſeem purpoſely varied in different perſons; for we do not find that any two deſcriptions of the moſt accurate anatomiſts agree, and we frequently find in the face luſus naturæ. That habit, however, has the power of giving one kind of expreſſion more ſtrongly marked, is beyond a doubt. Thus we ſee perſons of the ſame profeſſion, and who are uſed to direct their attention to particular objects, have the ſame reſemblance in their countenance.

CCXCVIII.

Muscles of the Throat and Tongue.

Os Hyoides.

As introductory to this part, the bones and cartilages which form the throat require to be demonſtrated. Theſe are the os hyoides and its appendages.

The os hyoides is a ſmall bone ſituated at the root of the tongue and top of the larynx, where it is placed to allow the inſertion of ſeveral muſcles into it, and where it ſerves for them as a lever or fixed point. In its ſhape this bone reſembles the Greek letter υ, being convex before, and concave behind. Its thick or middle part is named its baſis, and may be felt outwardly. The ſituation of this bone is an inch below the chin. It ſends out two horn-like proceſſes, which go backwards along the ſides of the throat, and are termed its horns. Theſe are tied by a ſtrong ligament from the ſtyloid proceſs of the temporal bone, and theſe horns again are united to its baſis by ſmall cartilaginous pieces, which are often converted into bones. Two ſmall proceſſes ſtand up from the griſly part of the bone at the joining of the horns, and are termed its upper ones. By the baſis of this bone is formed the root of the tongue and top of the larynx, with the epiglottis ſituated upon it, near that valve which regulates the opening of the windpipe. By its horns, the opening of the wind-pipe and gullet are preſerved extended, as it paſſes along the ſides of the throat. Hence it forms the centre of all the motions of theſe parts. To it the muſcles are appended which either raiſe or depreſs the throat, or move the tongue, and it connects them all together.

CCXCIX.

The trachea, or wind-pipe, is the paſſage to the lungs, at the top of which is placed the larynx, or principal organ of the voice, immediately under the os hyoides. It is compoſed of a variety of parts, the principal of theſe are its cartilages, on which the modulation of the voice depends. Theſe cartilages are five in number. The firſt is the ſcutiform or thyroid, and is placed at its upper and forepart, meeting on each ſide like flood-gates, being the largeſt of the whole. The place of this meeting is eaſily felt externally in the middle of the throat, and it forms that tumor known by the name of the Pomum Adami. The upper part, where the ſides of the thyroid cartilage unite, is formed into a notch; from which, and from the upper edge in general, aſcends a broad ligament to fix it to the under part of the os hyoides. From the poſterior corners, four proceſſes project, termed its horns; two of which, the ſuperior ones, aſcend to be joined by round ligaments to the extremities of the horns of the os hyoides. The inferior horns are curved backwards, and fixed to the ſides of the cricoid cartilage.

CCC.

The cricoid cartilage, the next in order, lies below the thyroid. It is named from its reſemblance to a ring or hoop, and may be alſo readily felt in the forepart of the throat. It is narrow before, and thick, broad, and ſtrong behind. It forms the top ring of the trachea, and the lower ring of the larynx; and upon both parts are ſeated two ſmall cartilages, which form the opening for the breath.

CCCI.

The two arytenoid cartilages are named from their reſemblance to a drinking glaſs. They are two ſmall bodies of the ſize of peas, and in their form ſomewhat triangular; the bone of which is placed upon the upper and poſterior edge of the cricoid cartilage, with the point a little crooked and hook-like directly upwards. In this form they compoſe an opening ſomewhat like a ſtrouped baſon, which opening aſſumes a proper rounded appearance, when they are covered with the thick membrane of the throat, interſperſed with mucous glands. This opening is named the rima glottidis, and the cartilage forming it being fixed as a hinge, they both form and modulate the voice in conſequence of their motions.

CCCII.

The epiglottis is a broad triangular cartilage, very elaſtic, and intended to defend the opening of the glottis. It is fixed at once to the os hyoides, to the thyroid cartilage, and to the root of the tongue, and it hangs backwards over the opening of the chink of the glottis, and may be ſeen and examined by preſſing down the root of the tongue. It is ſuſpended by ſmall peaks of membrane, called ligaments; and it is raiſed and depreſſed by various muſcles.

CCCIII.

Such is the form of the larynx. Compoſed of hard cartilage, it reſiſts compreſſion; and peculiar in the form of its opening, it compoſes and modulates the voice. Before, the opening of the larynx is defended by the thyroid cartilage, which goes alſo far backwards. The arytenoid cartilages are ſupported by the cricoid, which raiſes them by its deepneſs behind, and then occaſions the opening of the glottis to be well defended by the thyroid cartilage. The arytenoid cartilages form the opening or chink on which the power of voice, its various modulations and tones, depend. Theſe cartilages require often the niceſt regulation and movement of their muſcles; while the epiglottis or valve protects this part from injury, by flapping on the ſmalleſt irritation, and preventing it having acceſs to its cavity. With this introduction the uſe of the muſcles of theſe parts will be underſtood.

CCCIV.

Muſcles of the Throat.

The muſcles of the throat are divided into thoſe which pull it down, and thoſe that draw it upwards.

CCCV.

Sterno-Hyoideus.

Of the former, the firſt is the ſterno-hyoideus, which paſſes from the ſternum to the os hyoides. In its form it is a uniform, flat, ſmooth, fleſhy muſcle, ariſing from the upper and inner part of the ſternum, and inſerted into the baſe of the os hyoides.

CCCVI.

Sterno-Thyroideus.

This muſcle paſſes from the ſternum to the thyroid cartilage; and is, like the former, uniform, ſmooth, thick, and fleſhy. It ariſes from the upper and inner part of the ſternum, and partly from the cartilage of the firſt rib. It runs along the forepart and ſides of the trachea and thyroid gland, and it is implanted into the under and lateral part of the thyroid cartilage. Its action is to draw the larynx downwards.

CCCVII.

Omo-Hyoideus.

This is a muſcl [illegible] muſcle of great length, and very ſlender, reaching from the ſhoulder to the os hyoides. It is flat and fleſhy, though not ſo broad as the two former. It lies along the ſide of the neck, and has its belly divided at the middle by a croſs tendon, which forms it into two heads. It ariſes from the ſuperior notch of the ſcapula, and is inſerted into the baſe of the os hyoides, at the ſide of the firſt muſcle.

CCCVIII.

By the action of theſe three muſcles is the throat pulled down. By the two former this is performed in a direct manner, by the laſt it is drawn to one ſide, though by the concurring action of both, it is equally direct.

CCCIX.

The muſcles which elevate the throat follow next. Theſe are,

Mylo Hyoideus.

Firſt, the mylo-hyoideus, which ariſes from the inſide of the lower jaw, or from the backmoſt molaris to the point of the chin, where it joins its fellow. It is inſerted into the body of the os hyoides, and it is joined to its fellow by a white tendinous line. Its action is to pull the os hyoides both upwards, forwards, and to a ſide.

CCCX.

Genio-Hyoideus.

This muſcle ariſes from the chin at a rough point or tubercle at the inner ſide of its ſymphiſis. Its beginning is exceedingly narrow; as it proceeds downwards, it grows broad and flat, and is inſerted into the bone of the os hyoides by a broad edge. Its action is to draw the os hyoides towards the chin when the jaws are ſhut, or the chin towards the os hyoides, when the latter is fixed by the muſcles coming from the ſternum. The ſublingual gland lies flat betwixt this muſcle and the laſt.

CCCXI.

Stylo-Hyoideus.

This muſcle begins from about the middle of the ſtyloid proceſs, and paſſing obliquely downwards and forwards, is fixed at that part of the os hyoides, where its baſe and horn are joined. Its fibres ſplit above its inſertion, ſo as to allow the digaſtric muſcle to paſs.

This muſcle is often attended by another ſmall muſcle of the ſame name, but it is more ſlender.

When it is found, its origin, inſertion, and action are the ſame.

CCCXII.

Digaſtricus or *Biventer Maxillæ Inferioris.*

This muſcle is named from its double belly. It ariſes from a groove at the root of the maſtoid proceſs. It goes obliquely forwards and downwards, and forms a large round tendon, which is fixed by a ligament to the os hyoides; after which it runs obliquely upwards and forwards, and is inſerted at laſt into the bones and anterior part of the chin. Its action is to open the mouth, by pulling the lower jaw downwards and backwards; and when the jaws are ſhut, to raiſe the os hyoides, and of courſe the throat, as in ſwallowing. Hence it is properly a muſcle of the throat.

CCCXIII.

The next muſcles that fall to be demonſtrated, are thoſe that move the parts of the larynx on each other; and the firſt of them is the

CCCXIV.

Hyo-Thyroideus.

This fleſhy ſhort muſcle extends from the os hyoides to the thyroid cartilage. It ariſes from part of the baſe and horn of the os hyoides, and is inſerted into a rough oblique line at the ſide of the cartilage. Its uſe is to raiſe the thyroid cartilage, or depreſs the os hyoides.

CCCXV.

Crico-Thyroideus.

This muſcle is very ſhort. It ariſes from the ſide and forepart of the cricoid cartilage, and is inſerted by two portions, one into the lower edge of the thyroid cartilage, and the other into its inferior horn, by which means it is a little pointed below. The uſe of this muſcle is to pull the cricoid cartilage upwards and backwards, or the thyroid forwards and downwards; and thus by ſhortening the trachea, or compreſſing it ſlightly, in muſt affect the voice.

CCCXVI.

The muſcles of the voice are chiefly thoſe of the arytenoid cartilages, and which conſequently act by opening and ſhutting the rima glottidis. The firſt of theſe is the

CCCXVII.

Muſculus Arytenoideus Tranſverſus.

This muſcle lies acroſs betwixt the arytenoid cartilages at their back part. It ariſes from the whole length of one, to be inſerted into the whole length of the other. Its uſe is to draw the cartilages towards each other, and thus to clear the glottis.

CCCXVIII.

Arytenoideus Obliquus

Croſſes the other obliquely. It ariſes at the root of each arytenoid cartilage, and paſſes obliquely to the extremity of the oppoſite one. By the action of this muſcle and its fellow, the aperture of the glottis is cloſed.

CCCXIX.

Crico-Arytenoideus Poſticus.

This muſcle ariſes broad and fleſhy from the back part of the cricoid cartilage. It is of a pyramidal form, and is implanted by a narrow point into the back of the arytenoid cartilage. Its uſe is, by pulling the arytenoid cartilage directly backwards, to lengthen the opening of the glottis.

CCCXX.

Crico-Arytenoideus Obliquus.

The origin of this muſcle is from the ſide of the cricoid cartilage, where it is covered by the thyroid, and it is inſerted into the ſides of the arytenoid cartilage near its baſe. Its uſe, therefore, is to open the glottis by ſeparating the arytenoid cartilages, and with them the ligaments of the glottis, which are two cords that go within the covering from the tip of each cartilage to the back of the thyroid one; and while the former muſcle ſtrengthens theſe cords, the preſent will of courſe relax them.

CCCXXI.

Thyrio-Arytenoideus.

This muſcle is an aſſiſtant to the laſt. It ariſes from the back ſurface of the ſide of the thyroid cartilage, and is inſerted into the forepart of the arytenoid cartilage. By pulling the cartilage foreward and ſideways, it directly ſlackens the ligaments and opens the glottis.

CCCXXII.

Such are the ſeveral muſcles of the larynx, while thoſe of the pharynx follow next in the arrangement; and in entering upon them, we obſerve that in ſwallowing, the velum palati is drawn up and dilated as a preparatory ſtep; when it paſſes it, it again falls down, the opening of the throat is contracted, a compreſſion of the pharynx takes place, and the food is forced into the ſtomach.

CCCXXIII.

Azygos Uvulæ.

The azygos uvulæ is a ſmall ſlip of ſtraight fibres, which goes directly down to the uvula or point, in the centre of the pendulous curtain it ſeen hanging in the back part of the mouth. This muſcle ariſes from a ſharp point of the palate bones, and pulls the uvula directly upwards, ſo as to allow, by its action, any ſubſtance introduced into the mouth to paſs.

CCCXXIV.

Levator Palati Mollis.

This muſcle ariſes from the point of the pars petroſa of the temporal bone, and from the euſtachian tube and ſphenoid bone, and it is inſerted by a broad expanſion into the velum on which it is ſpread. By its action, the velum is pulled up or raiſed in the time of ſwallowing, and preſſed againſt the noſe, which prevents the food or drink from paſſing that way.

CCCXXV.

Circumflexus Palati

Ariſes from the ſpinous proceſs of the ſphenoid bone, and the beginning of the euſtachian tube, along which it runs down betwixt the pterygoid proceſſes. It then becomes tendinous, and turning under the hook of the internal pterygoid proceſs, it mounts again to the ſide of the velum. The uſe of this muſcle is to pull down the palate, and ſtretch it.

CCCXXVI.

Conſtrictor Iſthmi Faucium.

The origin of this muſcle is from the root of the tongue at the ſide, and it runs in the doubling of the ſkin which forms the anterior arch of the palate, being inſerted into the middle of the velum at the baſe of the uvula. By its action, the palate and root of the tongue are drawn to each other, and the opening of the throat thereby ſhut.

CCCXXVII.

Palato-Pharyngeus.

The fibres of this muſcle run within the poſterior arch of the palate, and paſs to the upper and lateral part of the pharynx. Its origin is from the middle of the velum, and it becomes implanted into the upper and back parts of the thyroid cartilage. Its uſe is to contract the arch of the fauces, by drawing the velum and uvula downwards, and to aſſiſt in conveying the food into the pharynx.

CCCXXVIII.

Before going farther in the deſcription of its muſcles, it is proper to demonſtrate the pharynx itſelf. This part, or opening into the gullet, forms a large and capacious cavity. It depends from the baſe of the ſkull, being fixed to the occipital bone, the pterygoid proceſſes, and back parts of both jaws. It terminates in the æſophagus or canal to the ſtomach, and forms as it were its mouth or funnel. Towards the mouth it is bounded by the baſe of the tongue and arches of the throat; behind it lies ſmooth on the vertebræ, and before it is environed by different parts of the larynx, which cover it with flat muſcular fibres, and ſerve as conſtrictors to it when contracted.

CCCXXIX.

Stylo-Pharyngeus.

This muſcle is a beautiful fleſhy expanſion on the ſide of the pharynx. It ariſes from the root of the ſtyloid proceſs, and is inſerted into the edge of the thyroid cartilage. By its action the pharynx is firſt raiſed and dilated, and then its top ſtraitened and compreſſed to puſh the ſubſtance down.

CCCXXX.

The other muſcles of the pharynx ought to be properly conſidered as one. They conſiſt of the circular fibres which ſurround it, and ſerve as conſtrictors when in action. Their various origins, however, occaſion their being demonſtrated as diſtinct parts.

CCCXXXI.

Conſtrictor Superior.

The firſt is named the conſtrictor ſuperior. It ariſes from the cuneiform proceſs of the occipital bone, from the pterygoid proceſs of the ſphenoid, and from each jaw near the laſt molaris. It ſurrounds the upper part of the pharynx, divided in the middle by a ſeam. By its action, the upper part of the pharynx is compreſſed for the purpoſe of thruſting down the food.

CCCXXXII.

Conſtrictor Medius.

This compreſſion is farther aſſiſted in the middle by the next muſcle which ariſes from the horn and appendix of the os hyoides, and alſo from the ligament which unites it with the thyroid cartilage. In its progreſs it goes upwards to touch the occipital bone, and downwards upon the next muſcle, by which it is hid in part.

CCCXXXIII.

Conſtrictor Inferior.

This muſcle ariſes from the crieoid and thyroid cartilages, and is divided by a tendinous middle line. Its uſe is the ſame as the others, to aſſiſt in compreſſing the part, and puſhing down whatever is introduced into the pharynx.

CCCXXXIV.

The laſt part, or æſophagus, is a ſimple continuation of the pharyngeal tube, lying flat on the back bone, and covered for its whole length with ſtraight muſcular fibres, different from the circular ones of the pharynx. From the manner in which theſe fibres are placed, they receive the name of the Sheath, or Vaginalis Gulæ.

CCCXXXV.

Muſcles of the Tongue.

The tongue is almoſt entirely compoſed of muſcles, which form its thickneſs, and enable it to perform all its motions. Theſe muſcles ariſe from the os hyoides, the chin, and the ſtyloid proceſs. Except its membranes, then, and its papillæ, the tongue is wholly muſcular.

CCCXXXVI.

Stylo-Gloſſus.

The firſt of its muſcles is the ſtylo-gloſſus, ſo named from its origin from the ſtyloid proceſs. Its courſe is obliquely downwards and forwards, ſo that it forms part of the ſide of the tongue, and it ſpreads out its fibres in radii. Its uſe is to move the tongue backwards, or into the mouth, and to one ſide.

CCCXXXVII.

Hyo-Gloſſus.

This muſcle is all that fleſh that ariſes from the length of the os hyoides, which is divided by the changing form of the bone, and this diviſion rendered it formerly diſtinguiſhed into different muſcles, under the names of the baſio gloſſus, chondro gloſſus, and cerato gloſſus. Its action is to depreſs the edges of the tongue, and thereby to render its upper ſurface convex.

CCCXXXVIII.

Genio-Gloſſus.

This muſcle has a narrow origin, but ſpreads out in the manner of a fan as it proceeds to the tongue, of which it forms the chief part, as its fibres ſtretch out in radii, and are directed both forwards and backwards. It ariſes from the rough tubercle behind the joining of the chin, and it is inſerted into the whole length of the tongue, and baſe of the os hyoides. Its action ſerves to move the tongue in various directions.

CCCXXXIX.

Lingualis.

The laſt muſcle is an irregular bundle of fibres extending the length of the tongue, and ariſing laterally from its root. In its progreſs it advances between the two former, and is inſerted into the tip. By its motion, the point of the tongue is raiſed, its length ſhortened, and it is drawn backwards.

CCCXL.

The moſt important of theſe muſcles is the genio-gloſſus. From its fibres proceeding in every direction, thoſe going to the point of the tongue pull it backwards, the fibres going backwards draw it forward, and thoſe in the middle make it hollow on the back, while the tip and root of courſe naturally riſe.

The hyo-gloſſus, compoſing the ſide of the tongue, pulls it downwards and rounds its back; and

The ſtylo-gloſſus, from forming the inſide of tongue, draws it deep into the mouth, and particularly influences its point.

CCCXLI.

After this general deſcription of the muſcles of the jaws, throat, and tongue, it is uſeful to conſider their mode of action in one united view; 1*ſt*, in taking food, and 2*dly*, in employing the voice.

In opening the mouth to receive the food, all the muſcles are employed that raiſe or depreſs either of the lips. The mouth is then ſhut by the orbicularis muſcle, and the fleſh of the lips and cheeks preſſed cloſe by the maſſeter and buccinator, for we ſcarcely aſſiſt much by the elevators of the lips, which rather tend to ſeparate the lips from the gums. In the mean time, by the motion of the jaws, the food is manducated. The maſſeter, temporal, and pterygoideus muſcles, are fitted for raiſing the jaw upwards, and that with different degrees of obliquity, as they act on both ſides more or leſs in concert; but it is chiefly the external pterygoideus which affects the lateral motions, moving the jaws alternately to the two ſides; or, it is uſed to bring the lower jaw forwards beyond the upper jaw, while it commonly falls within it.

CCCXLII.

While the food is manducated, it is confined by the motion of the tongue from being thrown inwards, and this organ is capable of more varied motions than could be expected from viewing the muſcles that are inſerted into it. It depends upon the circumſtance that has been ſhewn, the fibres of theſe muſcles being continued into the ſubſtance of the tongue; and it is probable that the terminations of theſe fibres act in a very different way from their origins, ſo that the muſcles ſerving to move the whole body of the tongue, may ſerve the purpoſe of a great variety. The muſculus lingualis, in particular, ſeems to have this varied action, juſt as the ſphincters of the bladder has its action, different from that of the very fibres that form it.

CCCXLIII.

When the food is ſufficiently manducated by the tongue, it is gathered up and carried backwards into the throat, which is chiefly done by the two ſtylo-gloſſi muſcles that pull the tongue backwards into the throat; while, at the ſame time, the tip of the tongue is raiſed to the roof of the mouth by the reſt of the muſcles. By bringing the tongue backwards with the food upon it, the muſcles connecting the tongue to the epiglottis are now relaxed, which comes to be preſſed down upon the glottis, and thus reſpiration comes to be ſtopped, and life being in danger, a ſudden effort of nature ſucceeds to relieve us, The ſeveral muſcles are now thrown into a convulſive action, particularly the digaſtric, by means of which an effort of ſwallowing is made, as well as by means of the others beneath it, which are all put into ſudden exertion, and at the ſame time. Thus the omo-hyoideus, the genio-hyoideus, and thyrio-hyoideus act, that the larynx may be pulled forwards along with the os hyoides; in conſequence of which the pharynx is dilated, and room is made for the food which is now thrown with violence over the epiglottis; or rather, the epiglottis and pharynx are drawn forwards ſo as to leave the food in the pharynx, and from the larynx being the forepart of the pharynx, it is mechanically dilated. In the time of this exertion, the noſtrils are ſhut in the moſt accurate manner.

CCCXLIV.

The food being now thrown with a conſiderable jirk into the pharynx, it is immediately irritated to perform its exertions, and the fibres in a circular oblique manner begin their contractions from an inſtinct of nature, which determines the motion downwards, and by the conſtrictors of the pharynx the food is puſhed into the æſophagus: but, as ſoon as it has deſcended a certain way, the digaſtric and other muſcles are relaxed, there being now no danger of the food aſcending again; and by the ſucceſſive action of the muſcular fibres of the æſophagus, it is thrown down into the ſtomach. That the pharynx is contracted in the moſt accurate manner, and that this contraction follows the food cloſe, appears from the accuracy with which fluids are ſwallowed, and air it is found can be ſwallowed with equal eaſe.

CCCXLV.

The formation of the voice, the next function of theſe parts, is made, as formerly noticed, by means of the ligaments of the larynx, and the voice is ſhaped into letters as the ſound paſſes through the mouth. But in inveſtigating this ſubject, we obſerve the great queſtion to be determined is, whether the voice is to be compared to a wind, to a corded inſtrument, or to both? The tones of wind inſtruments depend alone on the ſize and ſituation of their apertures, and the current of air through theſe, independent of the materials of which they conſiſt. The corded inſtruments again depend not only on the vibration of the cords, but alſo on the materials of which the inſtrument is formed. That the ligaments reſembling a corded inſtrument have much effect, is proved by cutting away the points of the arytenoid cartilages in a dead animal, when by blowing through the lungs, and giving a proper tenſion to the ligaments, the voice of the animal can be imitated. But that the ſtate of the aperture of the glottis is alſo eſſential, ſeems equally clear, from the muſcles being equally fitted for this purpoſe as for affecting the ligaments, and from conſidering alſo the manner employed when an acute or groſs note is intended to be ſounded. To do this, not the ligaments alone are employed, but by an inſtinct of nature an inſpiration is made, the diaphragm is depreſſed, the weight of air paſſes down the lungs, and ſtretches the trachea in all its branches, while the thyroid cartilage is likewiſe drawn ſtrongly upwards, and ſtretched to the full. Thus alſo it may be obſerved in whiſtling, that the notes depend upon the aperture as well as upon the tenſion of the ſides of the lips, which is proved in birds; where, if a hole is made in the trachea higher up, not only the ſtrength but tone of the voice is altered. Thus the larynx poſſeſſes the advantage not only of a wind but of a corded inſtrument, ſo far, that it unites them together; and inſtead of being acted upon by ſolid bodies as a corded inſtrument, it is acted upon in a much nicer way by the air thrown out of the lungs.

CCCXLVI.

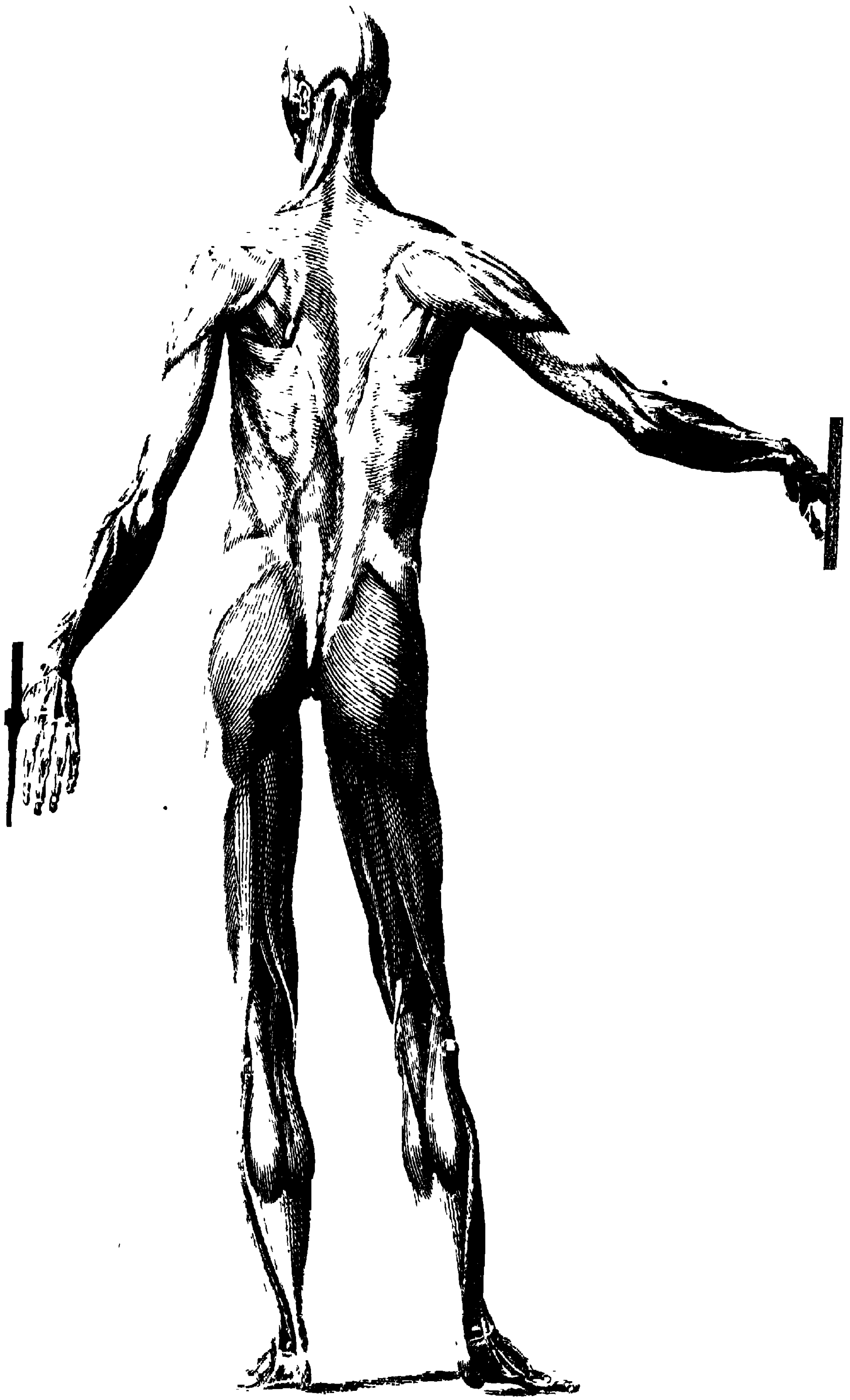
Muſcles of the Arm.

Varying ſomewhat in the plan of our arrangement from the demonſtration of the bones, we next proceed to the muſcles of the upper extremities; and thus we begin with the motions of the ſcapula.

CCCXLVII.

Muſcles of the Scapula.

The peculiar connection of the ſcapula to the trunk was formerly obſerved, looſe as it were, and yet connected and depending entirely on its muſcles for this junction. By the upper extremity being ſeparated into ſo many diviſions, the power of its motions and their variety is increaſed. Thus the ſcapula is the centre of its motions, and its action is therefore unconfined. The arm again requires only an eaſy circular motion, and by the number of its joints this circular motion is complete; for



by the ſhoulder joint the arm is rolled, the diviſion of the elbow limits this, and acts like a hinge, while the wriſt turns round, obedient to the motions of the other two.

CCCXLVIII.

The muſcles of the ſcapula ariſe from four different points correſpondent to their different motions. To move it forwards, their origin is the breaſt. To move it backwards, they proceed from the vertebral ſpines To move it upwards, their fixed point is the neck; and to move it downwards, they ariſe from the ribs.

CCCXLIX.

The firſt of them we enumerate is the trapezius, an extenſive occipital muſcle, which, with its fellow, covers all the ſhoulders and neck in a lozenge-like form. It is ſituated immediately under the teguments of the poſterior part of the neck and back. It extends from the tip of one ſhoulder to the tip of the other, and from the nape of the neck quite down to the loins. Its origin is by a thick, round, and ſhort tendon from the middle of the great arched ridge of the occipital bone, and from the tranſverſe ſpine quite down to the maſtoid proceſs, from its fellow over the ſpinous proceſſes of the cervical vertebræ by the intervention of that part of its tendon called ligamentum nuchæ or colli, from the ſpinous proceſſes of the two inferior vertebræ of the neck; and from all thoſe of the back, adhering tendinous to its fellow the whole length of its origin.

After this extenſive origin it becomes inſerted fleſhy into the broad poſterior half of the clavicle, tendinous and fleſhy into one half of the acromion, and into almoſt all the ſpine of the ſcapula.

From this various ſituation of its fibres in their action, they muſt have various or different effects. Thus its upper deſcending fibres pull the ſcapula obliquely upwards. Its middle tranſverſe ones draw it directly backwards. Its inferior fibres, which aſcend obliquely upwards, pull it obliquely downwards and backwards; and, when the whole of them come into action in ſucceſſion, the ſcapula will be rolled. Hence, alſo, the trapezius is a muſcle of the neck and head, as well as of the ſcapula, the upper part of it drawing the head backwards, and turning it on its axis.

CCCI.

Levator Scapulæ.

This long muſcle is ſituated obliquely under the anterior edge of the trapezius and ariſes, by four, ſometimes five, diſtinct heads, from the four or five uppermoſt vertebræ of the neck uniting to form it about three inches broad. It is inſerted by a flat thin tendon into the upper corner of the ſcapula; and its action is to ſhrugg the ſhoulders or raiſe the ſcapula upwards and a little forwards. It has been termed alſo muſculus patientiæ.

CCCLI.

Rhomboideus.

The rhomboid muſcle is ſtretched between the ſpine and the baſe of the ſcapula in a neat ſquare form. It ariſes from the ſpinous proceſſes of the four ſuperior vertebræ of the back, from the three inferior of the neck, and from the ligamentum nuchæ; and, deſcending obliquely, it is inſerted into the whole length of the baſe of the ſcapula. It is ſometimes divided into two muſcles, the upper part being termed the rhomboides major, and the under part the rhomboides minor. Both are ſeen on raiſing the trapezius. The uſes of this muſcle are to draw the ſcapula obliquely upwards, and directly backwards.

Thus, by the three muſcles deſcribed, is the ſcapula raiſed and drawn back; while, by the two next lying on the breaſt, it is moved down and drawn forwards.

CCCLII.

Serratus Major Anticus.

This muſcle lying on the ſide of the cheſt, ariſes from the ribs, and from the different interſtices placed between the ribs; hence it muſt ariſe by diſtinct portions, or be ſerrated. The chief part of this muſcle lies under the ſcapula, and is the cuſhion in part on which it glides; and its origins are the parts of it chiefly conſpicuous, which are from the nine firſt ribs, ſo that it covers the whole ſide of the thorax. It is inſerted into the whole line that forms the baſe of the ſcapula, being folded round its angles. Its action is to move the ſcapula forwards or downwards, according to the direction of its different digitations; and when the ſcapula is forcibly raiſed to aſſiſt in dilating the thorax by raiſing the ribs. It is chiefly by the contraction of this muſcle that the ſhoulder is ſupported when loaded with any heavy weight.

CCCLIII.

Pectoralis Minor.

This muſcle is ſituated at the anterior and lateral part of the cheſt, ariſing from the edges of the 3*d*, 4*th*, and 5*th* ribs, in a ſerrated form. Its three ſerrated points ſoon unite into a thick fleſhy muſcle, which is inſerted by a narrow ſlip or tendon into the upper part of the coracoid proceſs of the ſcapula. Its principal uſe, by pulling the coracoid proceſs, is to bring the ſcapula downwards and forwards; and when that is fixed, perhaps, to raiſe alſo the ribs.

CCCLIV.

Subclavius.

The ſubclavius is another muſcle hid by the ſcapula. It is ſituated between the clavicle and firſt rib, ariſing tendinous from the cartilage of the latter, and being inſerted into the under ſurface of the clavicle for nearly its whole length. Its action, therefore, is to pull the clavicle, and with it the ſcapula, downwards and forwards.

CCCLV.

By the deſcription, then, of theſe muſcles, the motions of the ſcapula will be underſtood. By the levator and trapezius, it is evidently directed upwards; by the rhomboides, aſſiſted in part by the trapezius, it is moved backwards. By the under part of the ſame trapezius, it is drawn both backwards and downwards. By the ſerratus major, it is pulled alſo downwards and forwards. By the ſerratus, along with the trapezius and ſubclavius, it is brought directly down, and by the pectoralis minor it is carried directly up. From theſe motions of the ſcapula, we proceed to the arm.

CCCLVI.

Pectoralis Major.

This broad, thick, radiated muſcle, covers almoſt the whole anterior part of the breaſt. It ariſes tendinous from two-thirds of the clavicle next the ſternum, from the whole ſternal edge, and fleſhy from the cartilaginous extremities of the fifth and ſixth ribs. It is intermixed in its courſe with the external abdominal muſcle, and is inſerted above the inſertion of the deltoid muſcle by a broad tendon into the os humeri. The upper or clavicular part of this muſcle is often ſeparated by a fatty line from the under or thoracic, ſo that they have been named as two diſtinct muſcles. The uſe of this muſcle is to draw the arm forwards towards the ſternum, and to aſſiſt occaſionally to move the trunk upon the arms, as when an exertion is made with the hand.

CCCLVII.

Latiſſimus Dorſi.

All the lower part of the back and loins receive a covering from this muſcle, the broadeſt in the body. It ariſes by a broad tendinous expanſion from the back part of the ſpine of the os ilium, from all the ſpinous proceſſes of the vertebræ, extending between the bottom of the os ſacrum and ſixth vertebra of the back, and by three or four tendinous ſlips from the ſame number of inferior ribs. From theſe different origins the fibres of the muſcle advance in different directions; the lower ones aſcend, the upper ones go directly acroſs; and theſe different orders not only meet, but croſs each other, like thoſe of the pectoral muſcle. It is inſerted by a long, flat, thin tendon into the poſterior edge of the groove between the two tuberoſities of the os humeri, where the tendon of the long head of the biceps is lodged; and where it is joined alſo by the tendon of the pectoralis. By the action of this muſcle, the arm is pulled downwards and backwards, and the os humeri is rolled inwards, by which the palm of the hand is made to fall backwards. When joined in action by the large pectoral muſcle, the arm is drawn down towards the trunk. It is by the union of theſe two muſcles, that the axilla alſo, or armpit, is formed; where they ſerve as a protection to the veſſels and nerves in that ſituation, the action of both is powerful, both from their own ſtrength as muſcles, and alſo from the manner of their inſertion. The office of the one, the pectoral, is to draw the arm forwards, while the other brings it down, when once raiſed, with much force, or rolls it inwards and backwards. By their joint operation the arm is pulled directly down, and by this means, on certain occaſions, the body may be raiſed.

CCCLVIII.

Deltoides.

This muſcle, ſo named from the Greek letter Δ, covers the anterior part of the joint of the os humeri, filling up the ſpace between the acromion and ſhoulder bone. It ariſes in three diviſions: *1ſt*, From all that part of the clavicle not occupied by the pectoral muſcle: *2d*, From the point of the acromion proceſs: And, *3dly*, From the ſpine of the ſcapula behind it. Thus it poſſeſſes three heads, or origins, from each of which it runs in different directions, ſeparated from each other by ſlight fiſſures, and forming as it were three diſtinct muſcles; for the fibres from the ſcapula run forwards, from the acromion downwards, and from the clavicle outwards. Theſe diviſions all meet about the middle of the humerus, in a ſhort flat ſtrong tendon, which nearly ſurrounds the ſhoulder bone. The principal uſe of the deltoid muſcle is to draw the arm directly upwards; and when the arm is raiſed, it will be moved a little forwards or backwards, according to the different directions of the anterior and poſterior portions of the muſcle. The different bundles of fibres, therefore, of this muſcle, in order to produce their full effect, muſt fall to act in ſucceſſion.

CCCLIX.

Coraco Brachialis.

This is a long ſlender muſcle, covered by the deltoid and pectoral muſcles. It ariſes tendinous and fleſhy from the forepart of the coracoid proceſs of the ſcapula, in common with the ſhort head of the biceps to which it adheres, and is inſerted into the middle of the internal part of the os humeri. From its beginning, which is ſmall, it gradually grows thicker as it deſcends, and is perforated at its lower part by the muſcular-cutaneous nerve. In its action, this muſcle is intended to give a degree of rotation, by bringing the arm obliquely upwards and forwards. It likewiſe aſſiſts in pulling the arm to the ſide.

CCCLX.

Supra Spinatus.

This muſcle is of conſiderable thickneſs, and occupies the hollow of the ſcapula above the ſpine. Its origin is from the baſe of the ſcapula, from the ſpine, and from the ſuperior coſta. It is inſerted tendinous into the large tubercle on the head of the os humeri. Its uſe is to raiſe the arm directly upwards, and at the ſame time, from its attachment to the capſular ligament, to pull it from between the bones, ſo that it may not be catched or pinched by the joint. It may alſo ſerve to move the ſcapula upon the humerus.

CCCLXI.

Infra Spinatus.

The triangular cavity below the ſpine, is the ſeat of this triangular muſcle, which is conſiderably covered by the deltoid. It is thick and ſtrong, and covered by a ſtrong tendinous expanſion. It ariſes fleſhy chiefly from all that part of the baſe of the ſcapula, that is between the ſpine and its lower angle, and it is inſerted into the upper poſterior part of the large protuberance on the head of the os humeri. By its action, this muſcle ſerves to turn the os humeri outwards upon its axis,- to aſſiſt in raiſing and ſupporting it when raiſed, and to pull, like the former muſcle, the ligament from between the bones. Perhaps, in conjunction with the former, to prevent alſo the humerus, when the arm is much bent backwards, from ſtarting from its ſocket.

CCCLXII.

Teres Minor.

This muſcle, ſo named from its appearance, is a long ſmall fleſhy one. It is ſituated along the inferior part of the infra ſpinatus, and partly covered alſo by the deltoid. It ariſes from the angle and lower edge of the ſcapula, and it is inſerted tendinous into the back part of the large protuberance on the head of the os humeri, a little below the former muſcle. Its uſes are the ſame with the infra ſpinatus.

CCCLXIII.

Teres Major

In its ſhape reſembles the former, but is longer and thicker, and lies lower upon the edge of the ſcapula, being ſituated at the under part of the teres minor, and ſending off a broad flat tendon, which accompanies the latiſſimus dorſi; and which, with the tendon of this laſt, is included in one common ſcapula, or ſheath. Its uſe is to aſſiſt in the rotatory motion of the arm, and to draw it down and backwards, as an aſſiſtant to the latiſſimus dorſi.

CCCLXIV.

Subſcapularis.

This muſcle lines all the cavity of the ſcapula like a cuſhion, being the ſhape of the ſurface of the ſcapula, on which it lies. It is therefore triangular, ſtrong, and fleſhy. It ariſes from the three coſtæ, and inner ſurface of the ſcapula, adhering to all the riſings and depreſſions of this bone. It is inſerted tendinous into all the upper part of the internal protuberance at the head of the os humeri, and it goes round the head of the os humeri to its inſertion. By the action of this muſcle, the arm is rolled inwards, or drawn to the ſide of the body; and from its attachment to the capſular ligament, it conduces alſo to prevent the latter being pinched.

CCCLXV.

From this view of the muſcles of the arm, their particular effects will be apparent.

The inſertion of them at the head of the os humeri, naturally occaſions their drawing the arm upwards; and this motion we find the ſupra ſpinatus, the infra ſpinatus, and teres minor, to have. The ſame inſertion belongs to the deltoid, ſomewhat lower, which will of courſe increaſe its power.

The ſcapularis being inſerted oppoſite to the former, muſt poſſeſs an oppoſite effect, and draw the arm downwards and backwards; while the pectoralis and coraco brachialis being implanted into the outer edge of the bicipital groove, their action will pull the arm to the ſide, and ſomewhat upwards. The arm we have ſeen pulled directly backwards by the latiſſimus dorſi and teres major, from their inſertion by the lower ſide of the groove, and as they paſs under the arm to meet this point, the palm will be rolled by them inwards and backwards. As theſe ſeveral muſcles ſucceſſively act, the different rotatory motions of the arm will be performed.

CCCLXVI.

Nor muſt it be omitted, the ſhare theſe muſcles have, from their inſertion, in giving ſtrength and firmneſs to the looſe texture of the joint. Hence, as it requires, in order to poſſeſs a quick and varied motion, a looſe connection of its ligament and other parts, it is ſurrounded by the heads of ſtrong muſcles to prevent any injury which, in its exertions, the weakneſs of its texture might expoſe it to. By attending to the inſertions of the different muſcles, this circumſtance will be apparent.

CCCLXVII.

Muſcles of the Forearm.

The motions of the forearm are flexion and extenſion; and to perform theſe, four muſcles are appropriated.

CCLXVIII.

Biceps Brachii Flexor.

The firſt of theſe ariſes by two heads, from which it derives its name. It is a thick, ſtrong muſcle, feeling like a hard ball when in action. Its outer or long head begins by a ſlender tendon from the upper edge of the glenoid cavity of the ſcapula. Its inner head, or ſhort one, ariſes tendinous and fleſhy from the coracoid proceſs of the ſcapula. A little below the middle of the forepart of the os humeri, theſe two heads unite, and form a thick fleſhy belly. The inſertion of of this muſcle is into the tubercle of the radius, at its upper and inner part, and the tendinous expanſion on the aponeuroſis of the forearm, is formed by it in its progreſs. The principal uſe of this muſcle is to bend the forearm, and likewiſe to aſſiſt in rolling the radius upon the ulna from within, outwards, as in the motion of ſupination, or turning the palm upwards. From its origin it will alſo move the humerus, as well as the forearm.

CCCLXIX.

Brachialis Internus.

This muſcle, of an oblong ſhape, and conſiderable thickneſs and breadth, is ſituated immediately under the biceps. It is an aſſiſtant to the latter. It ariſes from two-thirds of the os humeri at its fore part, and comes down from each ſide of the deltoid, its head being forked. By a ſtrong flat tendon it is implanted into the cornoid proceſs of the ulna. The chief action of this muſcle is to bend the forearm, and to prevent the ligament of the joint from being pinched, though its connexion is rather ſlight for this purpoſe.

CCCLXX.

Triceps Extenſor.

All the poſterior part of the os humeri is occupied by this muſcle, which ariſes with three heads, and has been deſcribed as three ſeparate muſcles. The firſt middle or long head, ſprings broad and tendinous from the inferior coſta of the ſcapula, near its neck. The ſecond begins from the arm-bone below the great tuber; and the third, or ſhorteſt, ariſes from the back part of the os humeri, near the inſertion of the teres major. The three heads unite about the middle of the humerus, and cover the whole poſterior part of the bone adhering to it in their deſcent, and forming one thick muſcle, which is inſerted into the upper and outer part of the olecranon of the ulna, and partly into the condyles of the os humeri, adhering firmly to the ligament The ſimple action of this muſcle is to extend the fore-arm, or hinge-joint of the elbow, with great power.

CCCLXXI.

Anconæus.

The laſt muſcle of this part is the anconæus, a ſmall triangular one, placed on the back part of the elbow. Its origin is tendinous from the poſterior part of the condyle of the os humeri, and it is inſerted by oblique fleſhy fibres into the back part or edge of the ulna. The tendon of this muſcle adheres ſtrongly to the triceps, and its action is to aſſiſt the triceps in extending the forearm.

CCCLXXII.

Before leaving theſe muſcles, it is to be obſerved, that the aponeurotic expanſion, or condenſed cellular covering, forms alſo a ſource of attachment for them, although a ſecondary one, as well as the bones; and for this purpoſe it both dives between their fibres, as well as forms partitions or diviſions in their ſtructure. Thus we find one tendinous expanſion deſcends from the neck, which receives an addition by the tendon of the deltoid muſcle. In its farther deſcent, it covers all the arm, and receives at the forearm a farther addition from the biceps and triceps extenſor. In its deſcent, alſo, it gives off partitions among the muſcles, and theſe are fixed to the radius and ulna, the membrane itſelf being loſt inſenſibly upon the hand. It is thicker and ſtronger on the outſide than the inſide of the extremity, particularly on the forearm, at the under and back part of which it forms a thick and ſtrong tendon. By theſe expanſions a firm hold is given to the muſcles, their places preſerved, and an attachment given to many of their fibres.

CCCLXXIII.

Muſcles of the lower Part of the Arm and Hand.

The uſe of theſe muſcles is to bend the wriſt and fingers, and to roll the hand.

The wriſt is bent and extended by its flexors and extenſors.

The fingers are regulated in their motions by muſcles of a ſimilar uſe. And,

The hand is rolled, or its motions of ſupination and pronation made by its pronators and ſupinators, which motions conſiſt in turning the hand down, which makes its pronation, or reverſing this, and turning it upwards, which makes its ſupination.

CCCLXXIV.

The muſcles of theſe parts are chiefly named from their uſes. Their ſituations of origin and inſertion, as well as their uſes, are eaſily underſtood as they all ſpring from two points, and their uſes are confined, as noticed, to two kinds of motion.

The points of origin are the internal and external condyles. The former being the longeſt, gives moſt power. Hence, the muſcles of greateſt action and importance ariſe from this part, or the pronators and flexors. The latter is the ſhorteſt, and therefore gives leſs force of action to the muſcles; hence it is the origin of the ſupinators and extenſors.

CCCLXXV.

The muſcles ariſing from the internal condyle, firſt claim attention.

Pronator Teres Radii.

The firſt, or pronator teres radii, is a ſmall round muſcle, ſo named from its office. It ariſes fleſhy from the internal condyle of the humerus and the coronoid proceſs of the ulna; and between theſe two paſſes the radial nerve. From theſe origins it runs obliquely downwards and outwards, and is inſerted tendinous into the middle of the poſterior part of the radius. By the action of this muſcle the hand is turned downwards by turning the radius inwards, or placed in a ſtate of pronation. It will alſo have ſome influence in bending the forearm in ſtrong action.

CCCLXXVI.

Palmaris Longus.

Immediately under the teguments is the ſituation of this long thin muſcle, which ariſes tendinous from the internal condyle of the os humeri, and alſo from the inter-muſcular tendon; and after paſſing down about three inches, it terminates in a long ſlender tendon, which near the wriſt ſeparates into two portions, one of which is inſerted into the internal angular ligament, and the other loſes itſelf in a tendinous membrane, but is nearly of a triangular ſhape, and extends over the palm of the hand from the carpal ligament to the roots of the fingers, and is called the ~~palmar~~ aponeuroſis, under which all the muſcles and veſſels of the hand run. After its expanſion on the palm of the hand, this is fixed to the roots of all the fingers by an equal number of double ſlips. This muſcle is ſrequently wanting, but the aponeuroſis is always to be found. Its action is to bend the hand, and particularly to ſtretch the aponeuroſis. It may alſo aſſiſt in its pronation.

CCCLXXVII.

Palmaris Brevis.

This muſcle ariſes by ſmall bundles of fleſhy fibres from the palmar aponeuroſis, near the annular ligament. It ſtretches acroſs the hand, and is inſerted into the metacarpal bone on which the laſt finger ſtands, and into the ſkin and fat which covers the edge of the palm. By its action it aſſiſts in contracting the palm of the hand.

CCCLXXVIII.

Flexor Carpi Radialis.

This is a long thin muſcle, ſituated obliquely at the inner and anterior part of the forearm. It ariſes from the inner condyle, ſtretching along the middle of the forearm, and it terminates in a long flat tendon which runs into the annular ligament in a groove peculiar to itſelf; and afterwards expanding a little it is inſerted into the metacarpal bone of the forefinger, touching that one which ſupports the thumb. By its action it bends the wriſt, and aſſiſts in the pronation of the hand.

CCCLXXIX.

Flexor Carpi Ulnaris

Is a long muſcle that ariſes tendinous from the inner condyle of the os humeri, and by a ſmall fleſhy beginning from the inner ſide of the olecranon. Its courſe is along the under edge of the forearm. Between its heads, the ulnar nerve perforates this muſcle. It receives various attachments in the courſe of its progreſs, and is at laſt inſerted into the os piſiforme at its forepart, where it ſends off a thin tendinous expanſion to cover the annular ligament, and a ſimilar one to cover the muſcles of the little finger. The action of this muſcle is to aſſiſt the former in bending the wriſt, to ſerve as a balance to it; and, by the action of this one alone, the edge of the hand is pulled ſideways.

CCCLXXX.

Flexor Digitorum Sublimis.

This is a long muſcle ſituated at the anterior and inner part of the forearm. It is termed ſublimis from its ſituation, being the moſt ſuperficial of two muſcles, and perforatus, from being perforated by the tendon of the muſcle below. Both its belly and tendons are divided into four faſciculi, correſponding to the different fingers it is to ſerve. It ariſes from the inner condyle of the os humeri, from the ligament of the elbow joint, from the coronoid proceſs of the ulna, and from the upper and fore part of the radius, down to near the inſertion of the pronator teres. It is inſerted into the anterior and upper part of the ſecond phalanx of the fingers, being ſplit and twiſted to form a paſſage near the under part of the firſt phalanx. The uſe of this muſcle is to bend the ſecond joint of the fingers, beſides which, it muſt alſo move the hand upon the wriſt, and even the forearm upon the arm from the number of joints it paſſes over, and the connections it conſequently forms.

CCCLXXXI.

Flexor Digitorum Profundus

Correſponds in its ſituation and offices nearly with the former. It lies deeper, and ariſes fleſhy from the external ſide and upper part of the ulna for ſome way downwards, and from a large ſhare of the interoſſeous ligament. About the middle way, downwards, it divides into four portions or tendons, to anſwer the four fingers. Theſe run through the ſlits of the former muſcle, and are inſerted into the anterior and upper part of the laſt bone of each finger. The office of this muſcle is to bend the laſt joint of the finger, and in its courſe, to perform the ſame actions as the former muſcle.

CCCLXXXII.

Lumbricales.

As an appendage to the laſt muſcle, fall to be demonſtrated the lumbricales, which ariſe from the outſide of its tendons, a little above the lower edge of the annular ligament of the wriſt. They are four ſmall round muſcles, in form and ſize reſembling the earth-worm, and therefore ſo named. They are of different ſizes, and ſend off long ſlender tendons at the under ends of the metacarpal bones, which are implanted into the outer ſides of the broad tendons of the interoſſeous muſcles, about the middle of the firſt phalanx, about the bone of which they gradually wind. By their action, the firſt joint of the fingers is bent, and the ſecond alſo extended, ſo that they increaſe the flexion of the fingers, while the long flexors are in full action. Their power is chiefly conſpicuous in ſhort quick motions, as in playing on the fiddle.

CCCLXXXIII.

Flexor Longus Pollicis.

This muſcle runs along the inner ſide of the radius. It begins by an acute fleſhy origin from the fore part of the radius downwards, and interoſſeous ligament, till it reach the pronator quadratus muſcle; and beyond this, it even paſſes to the entry under the ligament of the wriſt. Beſides this origin, it frequently has another from the internal condyle of the os humeri. It is inſerted into the laſt joint of the thumb, after paſſing its tendon under the anterior annular ligament of the wriſt. Its uſe is to bend the laſt joint of the thumb, and to aſſiſt in bending the other joints it paſſes over like the former flexors.

CCCLXXXIV.

Pronator Quadratus.

The name of this muſcle is derived from its uſe and ſhape It ariſes tendinous and fleſhy from the lower and inner part of the ulna, and runs nearly in a tranſverſe direction to be inſerted into that part of the radius which is oppoſite to its origin. Its uſe is to turn the radius upon the ulna, and then to aſſiſt the pronator teres in the pronation of the hand.

CCCLXXXV.

This finiſhes the muſcles ariſing from the internal condyle of the humerus, thoſe that take their riſe from the external condyle, or the extenſors, come next into review.

CCCLXXXVI.

Supinator Radii Longus.

The firſt is the ſupinator radii longus, which forms the very edge of the forearm. It ariſes by many ſhort fibres from the ridge of the os humeri, above the external condyle, nearly as high as the middle of the bone. It forms a thick fleſhy belly as it paſſes the elbow joint, and there gives a peculiar form to the arm. It then becomes ſmall, and forms a tendon along the edge of the radius, which is inſerted into the outer ſide of its under end. In its action this muſcle rolls the radius outwards, and of courſe turns the hand into a ſupine ſituation, with the palm forwards. It is alſo, in ſome degree from its origin, a flexor of the forearm.

CCCLXXXVII.

Extenſor Carpi Radialis Longior.

This muſcle is almoſt entirely covered by the laſt, and is named longior, to diſtinguiſh it from it. It ariſes from the ridge of the humerus above the external condyle, and juſt under the origin of the former. Its courſe is along the back of the radius, where it is thick and fleſhy till it reaches its middle, when it ſends off a thin flat tendon. This paſſes down firſt upon the outer, and then upon the back part of the radius, deſcending there in a groove, and going under the annular ligament of the wriſt. It is inſerted into the upper, back, and outer part of the metacarpal bone of the forefinger. Its principal uſe is to extend the wriſt, and bring the hand backwards

CCCLXXXVIII.

Extenſor Carpi Radialis Brevior.

This muſcle agrees entirely with the former in its deſcription and uſes. It ariſes from the external condyle of the os humeri, and from the ligament which connects the radius to it. Its tendon paſſing down the back part of the radius, goes under the annular ligament in the ſame groove with the tendon of the former muſcle. It is inſerted into the forepart of the tendon of the middle finger, a little towards that edge next the radius. Its uſes are to aſſiſt the former muſcle in extending the wriſt, and to draw the hand, with the aſſiſtance of the flexor carpi radialis, to the ſide next the thumb.

CCCLXXXIX.

Extenſor Carpi Ulnaris.

This muſcle ariſes tendinous from the external tubercle of the os humeri, and lies along the ulnar edge of the arm. It becomes tendinous in the middle of its length, and its tendon is incloſed by a membranous ſheath in a groove at the back part of the ulna. It is fixed into the outſide of the lower head of the metacarpal bone of the little finger. By its action it aſſiſts the two former muſcles in extending the wriſt, or, with the aſſiſtance of the flexor ulnaris, it draws the hand towards the ſide, next the little finger.

CCCXC.

Extenſor Digitorum Communis.

This muſcle covers the middle of the forearm at its back, and lies between the extenſor radialis ſecundus and the extenſor minimi digiti. It ariſes from the outer condyle of the os humeri, and from the inter-muſcular membrane. It grows fleſhy and thick as it deſcends; and about the middle of the forearm divides into three or four tendinous ſlips. Theſe form ſo many roundiſh tendons, which are included in a thin membrane, and paſs altogether under the ligament to the convex ſurface of the carpus, when they ſeparate from each other, and become flatter and more expanded. About the extremities of the metacarpal bones they ſend off tendinous filaments to each other, and they are at length inſerted by a tendinous expanſion into the back part of all the fingers. The uſe of this muſcle is to extend the fingers.

CCCXCI.

Extenſor Minimi Digiti.

This long thin muſcle is ſituated immediately under the common teguments, and is often deſcribed as a ſlip of the laſt muſcle. Its origin is from the outer condyle. It paſſes down, gradually, increaſing in ſize; and its fleſhy fibres diſappear when it reaches the external annular ligament, under which it paſſes in an oblique direction, and in a channel peculiar to itſelf. When this tendon reaches the metacarpal bone of the little finger, it ſends off filaments which unite with the tendon of the extenſor communis, and the reſt of it is inſerted into the phalanges of the little finger; which, from its name, it ſerves to extend, as alſo the others by its communicating band.

CCCXCII.

Extenſor Primus Pollicis.

This muſcle, termed alſo abductor longus, lies juſt under the fore edge of the radius, ariſing with it, and croſſing it obliquely. It divides into three or four fleſhy ſlips, which paſs under the external ligament of the carpus, and are fixed into the roots of the firſt phalanx of the thumb towards the radial edge. Hence the uſe of this muſcle is to extend the thumb, and to incline it a little outwards towards the radius, or to draw it from the fingers. Other motions it may alſo aſſiſt in.

CCCXCIII.

Extenſor Secundus, or *Minor Pollicis*

Lies cloſe by the former, ariſing from the ſame edge of the radius, and it runs along with it in the ſame bending courſe. Its ſmall round tendon paſſes ſometimes in a peculiar channel. It goes over the metacarpal bone of the thumb, expands upon its firſt phalanx, and is inſerted juſt under the ſecond joint. The ſecond baſe of the thumb is extended by it upon the firſt; and it aſſiſts alſo in extending the wriſt.

CCCXCIV.

Extenſor Tertius Pollicis.

This muſcle correſponds with the two former. Its origin is from the ridge of the ulna, and its courſe is longer than the others. It is penniform in its deſcent to the ligament of the wriſt, and its tendon goes through in a peculiar ring. This tendon ſplitting, paſſes along the ulnar ſide of the firſt phalanx of the thumb, and reaching the ſecond, is implanted in it; from which, expanding, it proceeds to its inſertion at the root of the third phalanx. By the action of this muſcle, the different joints of the thumb are moved, particularly the laſt; and this motion extends alſo to the different parts it paſſes over, or to the metacarpal bone upon the carpus, and to the carpus itſelf.

CCCXCV.

Indicator.

The origin and courſe of this muſcle is much the ſame as the laſt. It has an acute fleſhy beginning from the middle of the poſterior part of the ulna, at the inner ſide of the extenſor ſecundus. It is attached ſomewhat to the interoſſeous membrane. Its tendon paſſes under the external annular ligament of the wriſt, along with thoſe of the extenſor communis digitorum, and from thence running along the convex ſurface of the hand, it is united at the lower end of the metacarpal bone of the forefinger with the tendon of the extenſor communis that goes to that finger, into the poſterior part of which they are both inſerted. By its action, all the joints of the forefinger are extended, and the common extenſor is aſſiſted by it in pointing that finger, independent of its effect on the joints over which it paſſes.

CCCXCVI.

Supinator Brevis.

This ſmall muſcle, ſituated at the upper part of the forearm, lies concealed under the ſupinator longus. Its origin is tendinous from the external condyle of the os humeri, from the outer and upper part of the ulna, and from the interoſſeous ligament. It paſſes over the external part of the radius, and is inſerted into its ridge. By its office, it is limited to that of rolling the radius outwards, and thus aſſiſting in the ſupination of the hand.

CCCXCVII.

Muſcles in the Hand.

To aſſiſt the larger muſcles deſcribed, a farther proviſion is made by a collection of ſmall ones ſeated in the hand itſelf. Theſe, from their quick action, obey every ſmall motion, and particularly aſſiſt the lateral motions of the thumb, and alſo of the little finger.

All the muſcles of the thumb, form the great ball on its inſide, and their different actions, are regulated by the different places of their inſertion.

CCCXCVIII.

Abductor Pollicis.

The firſt is the abductor pollicis, covered only by the teguments ariſing from the whole length of the metacarpal bone of the middle finger.

It paſſes acroſs the metacarpal bone of the fore-finger when its fibres converge, and ſend off a ſhort tendon to be implanted into the inner part of the root of the firſt bone of the thumb. Its office is to draw the thumb from the fingers, and to extend the ſecond bone upon the firſt.

There is frequently another muſcle of the ſame name, holding the ſame courſe, and performing the ſame office.

CCCXCIX.

Opponens Pollicis.

This muſcle, named alſo the metacarpal of the thumb, is implanted into the ſide of the thumb. It ariſes from the os ſcaphoides and the ligament of the wriſt, and it is inſerted into the under and fore part of the metacarpal bone of the thumb. Its uſe is to turn the firſt bone of the thumb upon its axis, and at the ſame time to bring it inwards, oppoſite to the other fingers, as in clinching the fiſt.

CCCC.

Flexor Brevis Pollicis.

This two headed muſcle, ſituated betwixt the forefinger and thumb, extends obliquely acroſs the two firſt metacarpal bones. It ariſes from the os trapezoides, magnum and unciforme, and it is inſerted into the firſt and ſecond ſeſamoid bone, and baſe of the firſt bone of the thumb. The uſe of this muſcle is to bend the firſt joint of the fingers upon the ſecond, and to move alſo the other joints it paſſes over.

CCCCI.

Adductor Pollicis.

This muſcle ariſes from the metacarpal bone of the middle finger, and goes directly acroſs the metacarpal bone of the forefinger to meet the thumb. In its ſhape it is triangular and flat, having its baſe at the metacarpal bone, and its point at the thumb. It is inſerted into the inner part of the root of the firſt bone of the thumb. Its particular uſe is to pull the thumb towards the forefinger.

CCCCII.

From the thumb being the opponent of the fingers, it is ſurrounded with muſcles which form its large upper ball of fleſh. By theſe muſcles it is bent and affixed to the hand; and in the ſame manner the muſcles of the little finger alſo ſurround it.

CCCCIII.

Abductor Minimi Digiti.

This is a thin fleſhy muſcle which helps to form the prominence at the inner edge of the palm of the hand. It ariſes fleſhy from the inner ſurface and inferior edge of the os piſiforme, and from the adjacent part of the internal annular ligament, and it is inſerted by a flat tendon into the firſt bone of the little finger laterally. Its uſe is to draw the little finger from the reſt by ſpreading it ſideways, and to aſſiſt alſo in ſome degree the flexors.

CCCCIV.

Flexor Parvus Minimi Digiti.

By the ſide of the laſt riſes this ſmall thin muſcle with the ſame courſe and inſertion. Its origin is the hook-like proceſs of the os unciforme, and from that part of the anterior annular ligament of the wriſt next it. It is inſerted by a roundiſh tendon into the inner part of the baſe of the firſt bone of the finger. Its uſe is to bend the little finger, and aſſiſt the former muſcle.

CCCCV.

Adductor Minimi Digiti.

This muſcle lies immediately under the former one, and is ſometimes named the metacarpal of the little finger. It ariſes from the ſame origin as the former, and is inſerted into the outſide of the metacarpal bone, which it reaches by turning round it. Its uſe is to bend the metacarpal bone, and bring this finger towards the reſt, ſo as to make it an antagoniſt to the others, and it reſembles in this reſpect the opponens pollicis. By its action, alſo, the external convexity of the carpus is increaſed, and thus *Diogenes*'s cup is formed.

CCCCVI.

Abductor Indicis.

This muſcle ariſes from the os trapezium, and from the firſt bone of the thumb. It is inſerted into the back part of the firſt bone of the finger. It is a muſcle of conſiderable breadth, and its action is to pull the forefinger towards the thumb.

CCCCVII.

Interoſſeous Muſcles.

The interoſſeous muſcles follow next in order, ſituated betwixt the metacarpal bones, to the ſides of which they are alſo attached; and by their action they bend the firſt, and extend the ſecond joint of each finger. They are divided into the external and internal; and though ſomething larger, they reſemble the lumbricales.

CCCCVIII.

External.

The external are ſituated directly on the back of the hand; they are four in number. They ariſe with double heads, and ſend their tendons twiſting round the ſides to the backs of the metacarpal bones, where they are inſerted along with thoſe of the lumbricales, and the extenſors of the back of the fingers.

CCCCIX.

Internal.

The internal are ſituated in the palm of the hand, and are three in number. Their origin is the ſame as the former, from the metacarpal bones and their interſtices, and alſo from the ligaments of the carpal bones. They are diſtinguiſhed by having two heads, and their tendons are joined to thoſe of the extenſor and lumbricales. Their particular enumeration is unneceſſary. They poſſeſs one common office of extending the fingers, and the tendons of the flexors join their tendons, ſo as to meet on the back of the fingers, which part is in conſequence covered by a ſtrong united band of tendinous fibres.

CCCCX.

After this full enumeration of the different parts that conduce to the motion of the upper extremity, it will be proper to conſider the co-operation of the muſcles in review. Thus, when we mean to raiſe the ſcapula, the muſcles are employed that decuſſate each other, the obliquity of the one balancing the obliquity of the other, viz. the upper part of the trapezius and the levator ſcapulæ. If we intend to pull it down to preſs any thing under the arm, the lower part of the trapezius is employed; for different parts of a muſcle may be employed at different times, and with it, at the forepart, the ſerratus major anticus, particularly the portion of it near to the lower angle, which moves it farther than a ſtraight muſcle could have done. If we intend to bring it backwards, the whole of the trapezius is employed, but more eſpecially the upper and lower ends of it: but the rhomboides can be alſo employed. To make it advance forwards, the leſſer pectoral and leſſer ſerratus are put in action: but the large ſerratus has a greater effect, drawing the whole ſcapula forwards. If a rotation again of the ſcapula is meant, the centre of its motion is the clavicle. Firſt, then, it turns upon the end of the clavicle: but to increaſe the rotation, the clavicle is rolled alſo; and for this rolling of the ſcapula, the muſcles are employed that are inſerted obliquely, and one of them only is put in action at a time.

CCCCXI.

The different muſcles again that act on the humerus are nine in number. To raiſe it, the trapezius and ſupra-ſpinatus are uſed; and to pull it a little inwards at the ſame time, the coraco brachialis, and a ſmall ſhare of the infra-ſpinatus are added. For drawing down the arm, the poſterior parts of the deltoid muſcle are uſed; and if we want to preſs it ſtrongly againſt the ſide, we employ the great pectoral and latiſſimus dorſi, ſo that it is by this muſcle that weight under the arm is ſupported. To bring the arm back, a combination of muſcles is brought to co-operate, as the latiſſimus dorſi and teres major: but to prevent theſe from rolling it, the teres minor and infra-ſpinatus are brought alſo into play, ſo that the arm is carried back in this way with conſiderable force: but if ſtill greater force is wanted, ſome others of the forearm are brought to co-operate; and in order even to extend their power, we bend the elbow. For bringing the arm forwards, the large pectoral, the coraco-brachialis, and latiſſimus dorſi, are had recourſe to. Thus, by a ſucceſſion of ſuch motions, the circular motion with the arm can be performed; beſides which, the humerus can be rolled, and its powers exerted with great force, by bending the forearm. This we do in ſtriking with a hammer, and the muſcles we employ for the purpoſe are the latiſſimus dorſi and teres major, with the ſubſcapularis; and farther aſſiſtance can be even given with the pectoral muſcle; but the ſtroke is chiefly given with the three firſt, while the teres minor and infra ſpinatus roll the arm in the reverſe way.

CCCCXII.

The motions of the elbow are more ſimple. For the purpoſe of flexion, the biceps and brachialis externus are employed; and for its extenſion, the triceps muſcle.

CCCCXIII.

But, independent of theſe powers of the muſcles, their actions may be conſidered in a ſtill more extenſive view. Thus, the muſcles that ſerve, to move the ſcapula, may be uſed to move the whole trunk; and a variety of muſcles can be brought into action by forming as it were a chain, and influencing a diſtant member. Thus, ſuppoſe the body laid on the ſide in bed, and an attempt is made to raiſe it, the os humeri is firſt drawn down with the latiſſimus dorſi, and the muſcles of the ſcapula, of the neck, and of the head, are gradually influenced; and thus the head and trunk is raiſed. Hence, the cauſe of pains in the ſide, &c. in the caſe of rheumatic affections, in conſequence of motions made at a conſiderable diſtance; and, by fixing the ſcapula, humerus, and forearm, the trunk of the body can be acted on.

CCCCXIV.

Viewing the muſcles of the upper extremity, we muſt be ſtruck with their amazing ſtrength. In life a weight can be ſuſtained by them that is ſufficient after death to tear them in pieces.

CCCCXV.

Muſcles ſeated on the Ribs.

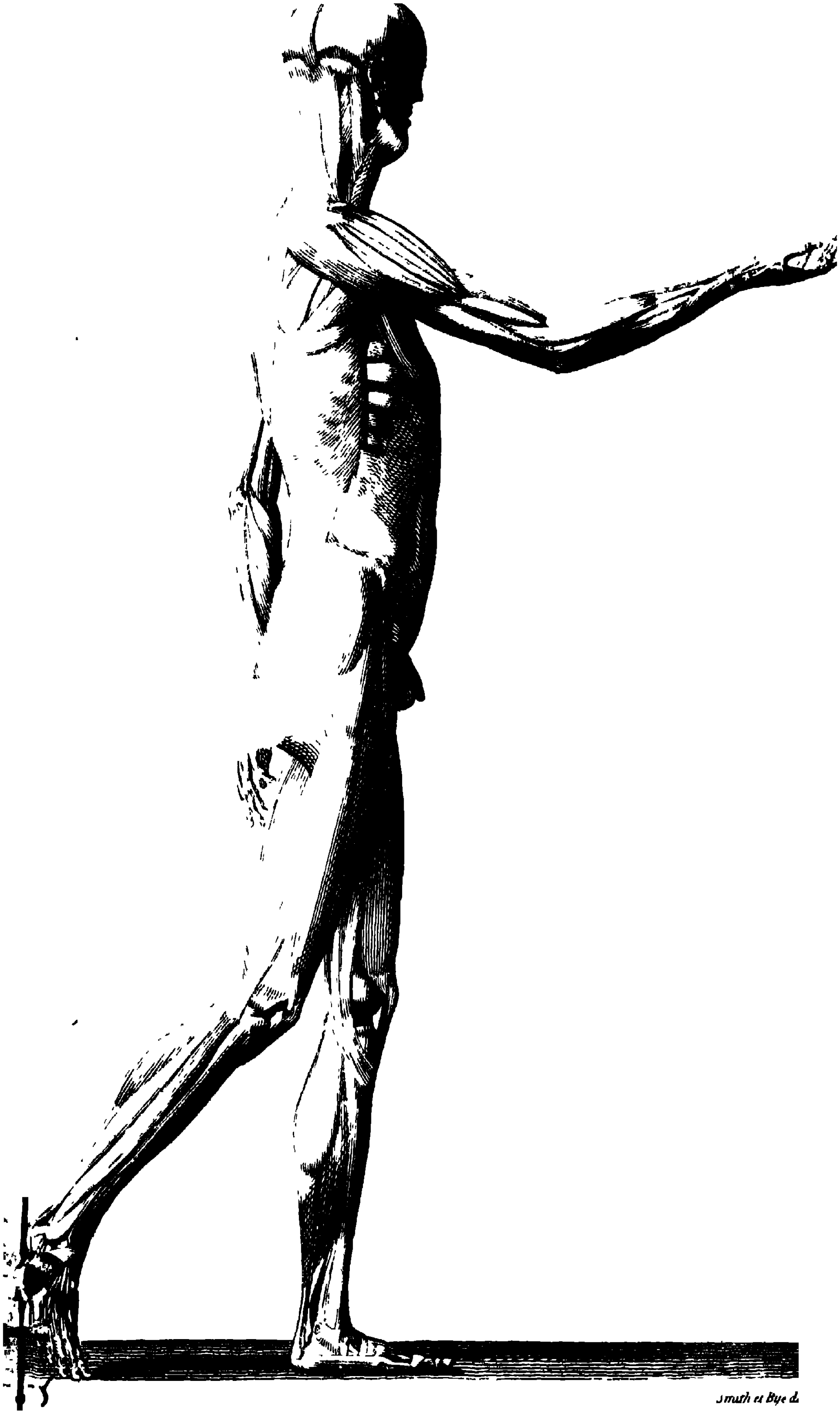
The peculiar muſcles of the ribs that move them in reſpiration, claim the firſt attention in demonſtrating thoſe of the trunk.

CCCCXVI.

Serratus Superior Poſticus.

The firſt of this deſcription is the ſerratus

P.252 Vol.I



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ſupèrior poſticus, which lies flat upon the ſide of the neck, and ariſes by a broad thin tendon from the ligamentum nuchæ, or from the three lower vertebræ of the neck, and the two upper ones of the back. It paſſes obliquely downwards, and is implanted by a ſerrated edge into the 2*d*, 3*d*, 4*th*, and 5*th* ribs, under the upper and back part of the ſcapula. The purpoſe of this muſcle is to expand the thorax, and by elevating the ribs, to dilate it in inſpiration.

CCCCXVII.

Serratus Inferior Poſticus.

This muſcle lies under the latiſſimus dorſi, *is* broad and thin, and has its origin in common with the latiſſimus dorſi, from the two inferior vertebræ of the back, and from the three ſuperior ones of the loins. It is inſerted in a ſerrated manner into the 9*th*, 10*th*, 11*th*, and 12*th* lower ribs, or their under edge, near their cartilages. The uſe of this muſcle is to depreſs the ribs, and thereby to aſſiſt in contracting the cavity of the thorax in the time of expiration.

CCCCXVIII.

Levatores Coſtarum.

Theſe are no leſs than twelve muſcles on each ſide, whoſe particular office is to lift the ribs. Their ſituation is either above or on the ribs, at their angles. Hence, their appellation of ſupracoſtales. In their ſhape they are nearly triangular. Their origin is from the tranſverſe proceſſes of the laſt vertebræ of the neck, and of the eleven ſuperior vertebræ of the back; and deſcending obliquely forwards and outwards, they are inſerted tendinous into the upper ſide of the ribs, near their tuberoſities. Thus, the firſt of them beginning at the laſt vertebræ of the neck, deſcends for its inſertion into the firſt rib; and ſo ſucceſſively each ariſes in order, and is fixed to the rib below. The ſuperior muſcles are ſmaller, thinner, and ſhorter than the three laſt, which differ ſo far in their inſertion, that they paſs one rib to be attached to the rib below it, and hence they are named levatores longiores. The uſe of this ſet of muſcles is to lift the ribs directly upwards and outwards.

CCCCXIX.

Intercoſtales.

But beſides theſe muſcles deſcribed, we find between the ribs, on each ſide, two rows of them, termed the external and internal intercoſtales. In their ſituation the external runs from the ſpine towards the ſternum; and their fibres are directed in the ſame manner, or from behind, forwards. Their limits are the cartilages of the ribs. The internal again reverſe this beginning from the ſternum, and paſſing on to the ſpine; and their fibres obſerve the ſame direction, ſtopping at the angle of the ribs. Hence they have been conſidered to decuſſate each other like the ſtrokes of the letter X. By their action, the cavity of the thorax is expanded in conſequence of the elevation of the ribs that takes place on inſpiration. Some of the inferior portions of the internal intercoſtals paſſing one rib, are inſerted into thoſe below, which has occaſioned their being deſcribed as ſeparate muſcles: but for this there is no proper foundation, as they are merely appendages that agree both in the ſame origin and uſe.

CCCCXX.

Sterno Coſtalis

Is a triangular muſcle, lying on the inner ſide of the ſternum, and extended in three or four ſeparate ſlips on the cartilages of the 3*d*, 4*th*, and 6*th* ribs. Its loweſt portion ariſes from the enſiform cartilage, and has its inſertion into the 3*d* and 4*th* rib; and its third portion, from the edge of the ſternum, is inſerted into the 3*d* rib. The fourth portion is often wanting; but goes generally from the 2*d* to the 3*d* rib. The uſe of this muſcle is to preſs the ribs into which its inſertions are made, and of conſequence to aſſiſt in contracting the cavity of the thorax in expiration.

CCCCXXI.

From this view, the power by which the motion of the ribs is performed, is beyond all doubt the contraction of both the rows of intercoſtal muſcles. At the ſame inſtant when theſe contract, the moſt moveable part is drawn towards one that is more fixed. The only difficulty here, and which has puzzled many anatomiſts, is to account for the obliquity of the intercoſtal muſcles; and, next, why there are two rows of them. This difficulty depends on the want of obſervation of a circumſtance of the firſt moment: that wherever extenſive motion is required, oblique fibres are employed; the oblique fibres giving a greater play than the ſtraight ones. Thus, as they contract more in proportion to their length, they bring the two ribs much nearer; and, in conſequence of their being two rows, the obliquity of the one balances the obliquity of the other, and raiſes the rib in an equal way, neither puſhing it backwards upon the ſpine, nor drawit forwards upon the ſternum.

CCCCXXII.

But it ſtill remains to explain, why the external intercoſtal muſcles, which run all from above obliquely forwards, are wanting near to the ſternum; and the internal, which run in a contrary direction, are wanting near to the ſpine. It clearly depends on the circumſtance of both rows co-operating in raiſing the ribs; for, if the external row had been brought forward to the ſternum, the laſt fibres would have been fixed to the ſolid bone of the ſternum, and would have drawn the ribs downwards. As ſoon, therefore, as they are brought ſo far forwards, that the diſtance at the place of inſertion bears a conſiderable proportion to the diſtance of the origin of the muſcles from the ſternum, the muſcle is wanting. In like manner, if the internal row went farther back, they would come to be fixed to the ſpine below, and to the rib above, at ſome diſtance from the head, which muſt have drawn the firſt rib down to the ſecond one. This motion then of the ribs we find all in one direction; and it is greater as we go farther from the top of the thorax, the ſecond rib having the motion of the firſt, and then its own motion, and ſo with regard to the reſt.

CCCCXXIII.

Muſcles of the Head and Neck.

On removing the external muſcle we have already ſeen, viz. the ſerratus ſuperior poſticus, the ſplenii then come into view; and after them the complexus is alſo expoſed.

CCCCXXIV.

Splenius.

This is a flat, broad, and oblong muſcle, ſo named from a ſplint applied to a fractured bone. Joined by its fellow, the two have the appearance of the letter Y. In their ſituation, they are placed immediately under the trapezii, and above the complexi.

The origin of the ſplenius is from the ſpinous proceſſes of the neck and breaſt, and it is inſerted into the back part of the head. It ariſes tendinous from the fourth and fifth ſpinous proceſſes of the dorſal vertebræ, from the laſt one of the neck; and at the ligamentum nuchæ, it unites inſeparably by tendon with its fellow. They afterwards recede; and it is inſerted by two tendons into the tranſverſe proceſſes of the two firſt vertebræ of the neck, into the upper and poſterior part of the maſtoid proceſs, and into a ridge in the occipital bone, where it joins with the root of that proceſs.

Beſides this part, which has been termed the ſplenius capitis, there is another portion lies under it, deſcribed as a ſeparate muſcle, under the name of the ſplenius colli. This part terminates by four or five diſtinct tendons in the tranſverſe proceſſes of the upper vertebræ of the neck, though it has the ſame common origin with the former.

By the action of the ſplenius, the head and upper vertebræ of the neck are turned obliquely backwards: when both ſplenii act, they pull the head directly backwards. They are the proper antagoniſts of the maſtoid muſcles.

CCCCXXV.

Complexus.

The name of this muſcle is derived from its complex ſtructure. It ariſes by diſtinct tendons from the tranſverſe proceſſes of the ſeven ſuperior vertebræ, of the back, and four inferior of the neck; and by a fleſhy ſlip from the ſpinous proceſs of the firſt vertebra of the back. In its paſſage upwards, it is intermixed with tendinous and fleſhy parts. It is inſerted into a depreſſion under the large arched ridge of the occipital bone. The appearance of the muſcle varies in different ſubjects, and it is ſometimes divided on that account into two portions, the inferior being termed biventer cervicis, and the upper, which is ſeen in the fork of the ſplenii complexus. By its ſingle action the head is drawn backwards and a little to one ſide; and when both act, it is pulled directly backwards.

CCCCXXVI.

Trachelo-Maſtoideus.

This muſcle is ſo named from its origin and inſertion, as alſo complexus minor. It ariſes from the three firſt vertebræ of the back, and from the five loweſt of the neck, at their tranſverſe proceſſes. It is inſerted into the maſtoid proceſs, juſt under the occipital inſertion of the ſplenius. Its uſe is to aſſiſt the former muſcle, but the head is drawn by it more to a ſide.

CCCCXXVII.

The next muſcles that follow are the recti. In their ſituation they lie deep, and are divided into the major and minor.

CCCCXXVIII.

Rectus Capitis Minor

Ariſes from the firſt vertebra of the neck, and is the ſhorteſt of the two, being inſerted fleſhy into the occipital ridge. It aſſiſts its fellow in drawing the head backwards.

CCCCXXIX.

Rectus Capitis Major

Is larger than the former muſcle, and has its origin from the external part of the ſpinous proceſs of the ſecond cervical vertebra. In its progreſs it becomes gradually broader, and goes obliquely upwards and outwards to be inſerted into the occipital bone, at the outſide of the inſertion of the former. By the action of this muſcle the head is pulled backwards, and its rotation alſo a little aſſiſted.

CCCCXXX.

Similar to the recti muſcles, except in their action, are the two obliqui; and like the former, they are divided into the major and minor.

CCCCXXXI.

Obliquus Superior.

The firſt, the obliquus ſuperior, ariſes from the tranſverſe proceſs of the firſt vertebra of the neck; and paſſing upwards and a little inwards, it becomes inſerted into the occipital bone, at the outer part of the inſertion of the rectus major. Its uſe is evidently to aſſiſt in drawing the head backwards.

CCCCXXXII.

Obliquus Inferior.

This muſcle ariſes from the ſpine of the ſecond vertebra of the neck, and paſſes to the tranſverſe proceſs of the firſt, where it meets the former muſcle. Its action is to roll the head, and thus by thoſe oblique muſcles, the ſhort quick turnings of the head are performed. This laſt muſcle moving the firſt vertebra upon the ſecond.

CCCCXXXIII.

When we obſerve in what manner the head can be moved, the combined action of the muſcles in moving it is very ſimple. In general, every muſcle draws its two points as much as the articulation will allow in a ſtraight line, and all the muſcles having ſlanting figures betwixt the head, draw it obliquely. But, if a pair of theſe are in action at the ſame time, the obliquity of the one balancing the obliquity of the other, they ſerve the purpoſe of a ſtraight muſcle. Thus, if we want to draw the occipital bone backwards in a ſtraight line, inſtead of employing muſcles which run very nearly in that direction, we can employ the muſculi trapezii which run in a ſlanting direction, and the head moves in a diagonal between them, and by their means the head can be thrown much farther back than could be done by a muſcle ſent directly from the bottom of the neck to the occiput. If the head is to be drawn ſtraight forwards, all the muſcles are employed on both ſides, whether ſtraight or oblique; and in like manner, when it is drawn backwards. But, for pulling it ſideways, we are obliged to employ an anterior and poſterior muſcle at the ſame time; ſo, in order to bring the maſtoid proceſs down to the ſhoulder, we act with the ſterno-maſtoideus and the ſplenius muſcles, which counteract each other; and, by a ſucceſſion of theſe motions, the head can be made to deſcribe a circle. Thus if, for example, the noſe is to be turned over the left ſhoulder, the moſt immediate for the purpoſe are the oblique inferior and ſuperior, ſhort, but very ſtrong muſcles; but we aſſiſt by the ſplenius of the ſame ſide, and to do it with its full ſwing, we alſo employ upon the oppoſite ſide the ſterno-maſtoid muſcle and the complexus; for the ſplenius and complexus croſs each other, and ſo are antagoniſts. The complexus, therefore, and ſplenius, on the oppoſite ſides, have the ſame direction, and muſt cooperate; and inverting the action of theſe muſcles, the head is turned with the ſame force backwards.

CCCCXXXIV.

Muſcles of the Trunk.

The great muſcles which move the back and loins, follow next in the order of our arrangement.

CCCCXXXV.

Quadratus Lumbarum.

The firſt of theſe is of a ſquare or oblong form, and ariſes from the poſterior part of the ſpine of the os ilium, and from the ligaments of the pelvis, which connect the ilium and ſacrum. It is inſerted into the tranſverſe proceſſes of all the lumbar vertebræ, into the laſt rib near the ſpine, and by a ſmall tendon into the ſide of the laſt dorſal vertebra. By this ſituation, it is placed laterally at the lower part of the ſpine. By its ſingle action, the loins are moved to one ſide; but joined by its fellow, they ſerve to ſupport the ſpine, and perhaps to bend it forward. In laborious reſpiration, it perhaps alſo aſſiſts in pulling down the ribs.

CCCCXXXVI.

Longiſſimus Dorſi.

This muſcle ariſes from the back part of the os ſacrum, ſpine of the ilium, and ſpinous proceſſes of the vertebræ of the loins. It forms a large, thick, and ſtrong muſcle, which fills up the hollow between the ſpine and the angles of the ribs. It gradually leſſens in its aſcent, and is inſerted into all the tranſverſe proceſſes of the vertebræ of the back by ſmall double tendons, and by a tendinous and fleſhy ſlip into the lower edge of each rib, except the two inferior ones near their tubercles. The uſe of this muſcle is to extend the vertebræ of the back, ſo as to keep the trunk of the body erect, and to draw it alſo back to one ſide.

CCCCXXXVII.

Sacro Lumbalis.

Ariſes from the ſame origin as the former muſcle; but it is farther from the ſpine, and it ſpreads its tendinous fibres broader upon the ſides of the thorax. Externally, in its appearance, it is all tendinous; and, internally, it is all fleſhy. Its inſertion is into the lower edge of each rib, by an equal number of tendons. From the ſix or eight lower ribs ariſe an equal number of fleſhy portions, which terminate in the inner ſide of this muſcle, and get the name of muſculi ad ſacrolumbalem acceſſorii. The action of this muſcle is to aſſiſt in raiſing and keeping the trunk of the body erect, in turning it upon its axis, or to one ſide, and in drawing the ribs downwards.

CCCCXXXVIII.

Both this muſcle and the former one, ſend up a fleſhy ſlip from their upper part, which is inſerted into the 5th and 6th inferior vertebræ of the neck by ſo many tendons. Theſe ſlips receive the names of tranverſalis, cervicis and cervicalis deſcendens. They, in action, turn the neck obliquely backwards, and to one ſide.

CCCCXXXIX.

Thus, by the action of the muſcles deſcribed, are the various motions of the trunk performed; for, by the firſt, or quadratus lumborum, it is inclined to one ſide; or, when both act, turned on its axis; and by the manner of inſertion of this muſcle is the breathing alſo aſſiſted. The ſecond muſcle, or longiſſimus dorſi, has its action confined entirely to the ſpine, ſo as to keep it erect; in which it is joined by the ſacro lumbalis, whoſe action, perhaps, is at the ſame time more extenſive. Its ſlip will co-operate with the other muſcles in that ſituation in turning the head to one ſide.

CCCCXL.

The back is the ſeat of a number of ſmall muſcles, which extend on each ſide of it to the edge of the ribs; and theſe muſcles have been divided by anatomiſts into a great variety. The firſt we ſhall conſider is the

CCCCXLI.

Spinalis Cervicis.

This ſet of muſcles is implanted into the ſpines of the cervical vertebræ. It ariſes by diſtinct tendons from the tranſverſe proceſſes of the five or ſix uppermoſt vertebræ; and aſcending obliquely under the complexus, it is inſerted by ſmall tendons into the ſpinous proceſſes of the ſixth, fifth, fourth, third, and ſecond vertebræ of the neck. Its action is to extend the neck obliquely backwards.

CCCCXLII.

Spinalis Dorſi.

This muſcle ariſes from two ſpinous proceſſes of the loins, and from the three lower ſpinous proceſſes of the back; and paſſing two, it is inſerted into all the ſpinous proceſſes of the back, except the uppermoſt. Its uſe is to extend the vertebræ, and to aſſiſt in raiſing the ſpine.

CCCCXLIII.

Semi Spinalis Dorſi

Ariſes from the tranſverſe proceſſes of the lower vertebræ of the back all but two, and is inſerted by ſmall tendons into the upper ſpinous proceſſes of the back, and the firſt of the ſpine. Its uſe is to extend the neck obliquely backwards.

CCCCXLIV.

Multifidus Spinæ.

This muſcle ariſes tendinous and fleſhy from the ſide and ſpinous proceſſes of the os ſacrum, and from that part of the ilium which joins with the ſacrum, from all the oblique and tranſverſe proceſſes of the vertebræ of the loins, from all the tranſverſe proceſſes of the vertebræ of the back, and of the four inferior of the neck. From all theſe origins the fibres of the muſcle run in an oblique direction, and are inſerted by diſtinct tendons into the ſpinous proceſſes of all the vertebræ of the loins and back, and alſo into thoſe of the ſix inferior vertebræ of the neck. The uſe of this muſcle is to retain the ſpine from being too much bent forwards, ſimilar to the uſe of a ligament. It alſo moves the ſpine backwards, and ſerves to erect it.

CCCCXLV.

Interſpinales Colli

Are the double fleſhy portions that occupy the ſpaces between the ſpinous proceſſes of the vertebræ of the neck, moſt of which are forked. They have their origin from each inferior ſpinous proceſs, and their inſertion into each ſuperior. By their action, theſe proceſſes are drawn nearer to each other, and of courſe the neck is pulled a little backwards.

CCCCXLVI.

Intertranſverſales Colli

Differ from the former in their ſituation, which is between the tranſverſe proceſſes of the vertebræ of the neck. They are alſo forked, and are filled up in like manner with double fleſhy portions. Their action is to draw theſe proceſſes towards each other, and to turn the neck a little to one ſide.

CCCCXLVII.

Interſpinales et Intertranſverſales Dorſi

Are ſmall tendons that ſerve to connect the ſpinal and tranſverſe proceſſes.

CCCCXLVIII.

Interſpinalis Lumbarum

Are the ſame as the former, and require no particular deſcription.

CCCCXLIX.

Intertranſverſalis Lumbarum.

Theſe are five diſtinct muſcles that occupy the ſpaces between the tranſverſe proceſſes of the laſt dorſal, and all the lumbar vertebræ, and ſerve to draw them a little to each other.

CCCCL.

Having finiſhed the muſcles of the trunk, we obſerve that its motion are more ſimple than thoſe of the extremity. For moving it ſideways, we employ thoſe muſcles immediately connected to the vertebræ; and, in its other motions, we take the aſſiſtance of the abdominal muſcles, and others not yet deſcribed. The muſcles of the forepart of the head and neck ſtill remain to complete the ſpine.

CCCCLI.

Platiſma Myoides.

This is properly a thin muſcular expanſion reſembling the ſubcutaneous muſcle of quadrupeds, and ariſing by a number of ſeparate fleſhy ſlips which cover the upper part of the pectoral and deltoid muſcles. It runs obliquely upwards along the ſide of the neck, and is inſerted into the ſide of the lower jaw, into the depreſſor anguli oris, and into the ſkin which covers the under part of the maſſeter muſcle and parotid gland. This part, by its action, will aſſiſt in depreſſing the ſkin of the cheek, the corner of the mouth, and the lower jaw; and when the jaws are ſhut, it will tend to raiſe all that part of the ſkin connected with it under the lower jaw.

CCCCLII.

Maſtoideus.

The maſtoid muſcle is divided in its origin between the clavicle and ſternum, and has been diſtinguiſhed accordingly by the name of ſterno-kleido maſtoideus; but its ſternal point forms its principal attachment. On the union of its heads, a little above the clavicle, it forms a ſtrong muſcle which runs obliquely upwards and outwards, and it is inſerted into the maſtoid proceſs by a broad tendon ſurrounding it, and which is even extended ſomewhat farther. The office of this muſcle is to turn the head to one ſide, and to aſſiſt in rolling it. When both muſcles act, they bow the head, or pull it directly forwards.

CCCCLIII.

Next to the maſtoideus, follow three muſcles lying under the æſophagus and trachea, flat upon the forepart of the vertebræ. The firſt of theſe is the

CCCCLIV.

Rectus Internus Capitis Major.

The origin of this muſcle is from the tranſverſe proceſſes of the 3*d*, 4*th*, 5*th*, and 6*th* vertebræ of the neck, and it is inſerted into the cuneiform proceſſes of the occipital bone, juſt before the foramen magnum. Its action is to bend the head forward.

CCCCLV.

Rectus Capitis Minor.

This ſmall muſcle lies immediately under the former. It ariſes from the forepart of the body of the firſt vertebra, and going obliquely inwards, it is inſerted into the occipital bone near the condyle. By its action it aſſiſts the former muſcle.

CCCCLVI.

Rectus Capitis Lateralis

Ariſes from the anterior part of the tranſverſe proceſs of the atlas. It paſſes obliquely outwards, and is inſerted into the ſide of the cuneiform proceſs of the occipital bone. It lies immediately under the paſſage of the great jugular vein.

CCCCLVII.

Longus Colli.

This is the principal muſcle on the forepart of the neck. Its origin is from within the thorax, from the ſide of the bodies of the three ſuperior vertebræ of the back, and from the tranſverſe proceſſes of the four inferior of the neck. It is inſerted tendinous into the forepart of the bodies of all the vertebræ of the neck, by as many ſmall tendons which are covered with fleſh. By its action it bends the neck forwards and to one ſide, or when both muſcles act, they immediately bend the neck.

CCCCLVIII.

Scalenus.

This is one great triangular muſcle, flat, and ſtretching from the ribs to the neck, cloſing as it were the thorax above, and giving paſſage to the nerves and veſſels of the arm. It has been divided by anatomiſts into ſeveral parts; but theſe may be confined properly to three.

The anterior portion ariſes from the tranſverſe proceſſes of the ſix inferior vertebræ of the neck, and is inſerted into the flat part of the firſt rib, hard by its cartilage. The origin of the middle portion is from the four laſt vertebræ of the neck to the outer edge of that rib, extending along it all its length; and the poſterior portion ariſes from the tranſverſe proceſſes of the 2*d*, 3*d*, and 4*th* vertebræ, being inſerted into the upper edge of the rib, at the diſtance of about $1\frac{1}{2}$ inch from its articulation with the ſpine. Through the firſt portion, the artery paſſes about an inch above the axilla, and the nerves paſs in the interſtice between the firſt and ſecond portion. The office of this muſcle is to move the neck to one ſide when acting ſingly; but when both act, they move it forward; and when the neck is fixed, they perhaps alſo aſſiſt to raiſe the ribs.

CCCCLIX.

From the muſcles of the trunk, we now proceed to thoſe of the abdomen, or belly; which, while they cover this cavity, take a ſtrong hold both of the trunk and pelvis; and this cavity is alſo divided from the trunk by a ſtrong muſcular partition, conſtantly in action, termed the diaphragm. From the various and important offices of theſe abdominal muſcles, as well as of the diaphragm, their conſideration is a ſubject of much importance.

CCCCLX.

The abdominal muſcles are ten in number, five on each ſide. The three firſt, or the two oblique and tranverſalis, by their broad layers fill up the ſpace between the cartilaginous edges of the falſe ribs and the bones of the pelvis; and the union of their tendinous fibres with each other from the oppoſite ſide, fill a ſpace termed the linea alba, extending from the enſiform cartilage to the pelvis. The two laſt muſcles, the rectus and pyramidal, have their ſituation at the ſide of this linea alba.

CCCCLXI.

Obliquus Externus.

The firſt, or obliquus deſcendens, is a broad, thin, ſerrated muſcle, ſituated immediately under the teguments, and ariſing by indentations from the eight lower ribs. Its fibres run obliquely downwards and forwards; and one half of it, or its fleſhy belly, covers the back part of the abdomen, while the fore part is covered by its tendinous expanſion. It is inſerted into its fellow of the oppoſite ſide by the linea alba, formerly noticed, which extends from the enſiform cartilage to the pubes, formed by the meeting of the tendons of the oblique and tranſverſe muſcles of the abdomen, and perforated in the middle by the umbilicus, originally the exit of the umbilical veſſels, now formed into a cicatrix. It is inſerted alſo into the anterior half of the ſpine of the os ilium and ligament of Poupart, which is a diſtinct ligament, and not the tendon of the external oblique, ſtretching from point to point. The uſe of this muſcle is to draw down the ribs in expiration, to bend the trunk forward when both muſcles act, or to bend it obliquely to one ſide, or turn it on its axis when operating ſingly. It alſo raiſes the pelvis obliquely, when the ribs are fixed; and, by ſupporting and compreſſing the abdominal viſcera, it aſſiſts all the evacuations that take place in the under belly.

CCCCLXII.

Obliquus Internus.

This muſcle is ſituated immediately under the external oblique, and ariſes from all the circle of the ſpine of the ilium, from the joining of the ilium and ſacrum, from the ſpine of the ſacrum itſelf, from the three lower ſpinous proceſſes of the loins, and from the ligament of the thigh. From theſe origins it proceeds upwards in a radiated form, but the greater part paſſes up in a ſlanting direction. It is inſerted into the cartilages of all the falſe ribs, into the ſternum, and into the linea alba, for its whole length. The uſe of this muſcle is to aſſiſt the former; but it ſeems more evidently calculated than that muſcle to draw the ribs downwards and backwards. It alſo ſerves to ſeparate the falſe ribs from the true ribs, and from each other.

CCCCLXIII.

Tranſverſalis.

This muſcle runs directly acroſs the belly. It ariſes from the cartilages of the ſeven inferior ribs, from the tranſverſe proceſſes of the laſt dorſal and four upper lumbar vertebræ, from the ſpine of the ilium, and from a part of the femoral ligament. Thus its origin reſembles that of the former muſcle. Its fibres croſs the abdomen, and it is inſerted tendinous into the linea alba its whole length, and into the enſiform cartilage. The uſe of this muſcle is evidently to ſupport and immediately compreſs the abdominal viſcera.

CCCCLXIV.

This firſt diviſion of the abdominal muſcles is thus ſituated in relation to each other. The external oblique is expanded broad upon the cheſt on its outſide. The internal is placed lower and more to a ſide, or towards the edge of the cartilages; while the tranſverſe takes its origin within the cheſt, or from the internal coſtal ſurface.

CCCCLXV.

Recti.

The recti muſcles form the firſt or anterior covering of the abdomen, and extend from the ſternum to the pubes. The former of theſe is their origin, which is broad and fleſhy, covering the outſide of the ſternum and its cartilage. It then extends down the abdomen of four inches breadth, and terminates by a flat pointed tendon at the ſymphyſis. It is croſſed in its courſe by different tendinous interſections, of which there are obſerved three above, and two below the umbilicus. Its office is to compreſs the forepart of the abdomen, to draw down the ribs, and to bend the trunk forward, or raiſe the pelvis. By its tendinous interſections, its action is preſerved more regular.

CCCCLXVI.

Pyramidalis.

This muſcle is evidently an appendage to the former. It ariſes from the anterior and upper part of the pubis, and is inſerted into the linea alba and inner edge of the rectus, commonly about two inches above the pubis. Its uſe is to aſſiſt the rectus to draw down the ſternum, and tighten the linea alba, thereby increaſing the power of the other muſcles, particularly the lower portion of the rectus. This muſcle often differs on the two ſides, and is ſometimes entirely wanting in one.

CCCCLXVII.

Having thus ſeen the ſeveral muſcles of the abdomen, we obſerve that as the rectus is puſhed out in a convex line when it acts, it brings itſelf ſtraight, and therefore puſhes in the belly and compreſſes it. Next, when it is brought into a ſtraight line, and that we are in a ſtate of full inſpiration, it will draw down the lower ribs, and aſſiſt in performing expiration; but, if the ribs are brought down, and we wiſh to bend the thorax or to puſh any thing away before us, we move the whole upper part of the body by means of it, or we draw the thorax nearer to the pelvis. The laſt effect is that, if the thorax be fixed, the pelvis will be drawn up towards the thorax. The pyramidalis concurs to produce theſe effects, and ſerves farther to compreſs the bladder.

CCCCLXVIII.

With regard to the oblique muſcles, their action may be reduced to the greateſt ſimplicity; for the external oblique of the one ſide has its fibres in the ſame direction with the internal of the other, ſo they may be conſidered as forming one digaſtric muſcle, and the ſame takes place with regard to the other two. Thus, when we draw down the thorax or raiſe the pelvis with a degree of obliquity, theſe muſcles are employed, but in other reſpects their action is ſimilar to that of the recti; for, if we act with them all, the ſlanting direction of the one balancing that of the other, the body is moved ſtraight.

The only remaining muſcle is the tranſverſalis. It can have very little effect in drawing down the ribs, and its action is very much confined to the conſtriction of the belly, ſo it reaches from bone to bone, and nature has thrown in a vaſt deal of tendon; for, if the fleſh had been continued, it would have ſtraightened the belly too much. Thus it is continued in ſheaths, and the effect of theſe is to increaſe the action of the rectus muſcle, and we accordingly do employ the tranſverſalis when we want to have its action more conſiderably increaſed.

CCCCLXIX.

With regard to the oblique, we find that the degrees of motion performed by them are greater than could have been made by ſtraight muſcles This is a circumſtance entirely overlooked, yet the influence of it is very powerful; the obliquity of the one muſcle balances the obliquity of the other, as already ſtated, when the body is brought forwards, and here the action is a good deal more extenſive than it otherwiſe could have been. Thus, ſuppoſe an action to be required by the rectus muſcle, and that the rectus can ſhorten itſelf $\frac{1}{3}$ of its length, and the thorax would have been drawn ſo much down. When two ſuch muſcles are placed ſlanting, and the obliquity of the one balances the obliquity of the other, the action is much more extenſive. In this part of the body, it is not often that we have occaſion for ſo great an extent of motion; but between the ribs, where the ſpace left for motion is very ſmall, this contrivance is very uſeful and neceſſary.

CCCCLXX.

Beſides what has been obſerved, it is by the action of the abdominal muſcles that the contents of the belly are carried downwards, delivery is aſſiſted, the circulation of the blood through the liver promoted, and by their influence on the trunk, even the actions of the lower extremities forwarded; by violent action with them, even the contents of the ſtomach can be thrown up by vomiting.

CCCCLXXI.

Connected with the muſcles, ſome parts of the abdomen already noticed deſerve a farther detail.

CCCCLXXII.

Linea Alba.

The firſt of theſe is the linea alba, or common meeting of the tendons of the abdominal muſcles on each ſide, which becomes of courſe their common point of action.

CCCCLXXIII.

The ſecond is the ſemilunar line, formed on the edge of the rectus muſcle, in order to form a ſheath for it of a circular form.

CCCCLXXIV.

The third is the ſheath of the rectus itſelf, which is a ſeparation of the tendons that meet in the ſemilunar line. Thus, the flat tendons of both the oblique muſcles go upon the outer ſurface of the rectus, and the ſheath is formed on that ſide, while the tendon of the tranſverſe lying under the rectus, forms its lower part. At the forepart again, or over the muſcle itſelf, the ſheath is complete till it ſtops about five or ſix inches above the pubes, where the pyramidal muſcles are ſituated, and which have no intervening covering between the internal cavity but the peritoneum. The back part of the ſheath poſſeſſes little attachment, and is eaſily raiſed; but the forepart of it adheres firmly to the muſcle, forming the interſections which divide it into ſeparate bellies, and a ſeparation cannot be made at this part without injuring the muſcle.

CCCCLXXV.

The umbilicus is the central opening of the abdomen, placed in the middle of the linea alba, and giving exit to the fœtal nutriment through its veſſels. In the adult, the extremities of theſe veſſels degenerate into ligament, and the part cloſes in the form of a ring. This opening, however, is at times forced by violent action of the abdominal muſcles or other exertions.

CCCCLXXVI.

A lower opening, juſt over the pubes, and a highly important one, is the ring of the abdominal muſcle through which the ſpermatic veſſels paſs in men, and the round ligaments of the uterus in women. This ring is formed by the external oblique muſcle, the tendon of which forms a ſplit, which begins about an inch and a half above the pubes. It is oblique, and conſiſts of two legs, looking towards the pubes. The upper one, or pillar, which forms the ſuperior part of the opening, goes directly towards the creſt or higheſt point of the pubes, the lower pillar or ſlit forming the low line of it, turns in behind, gets under the upper one, and is implanted into the pubes within and behind the upper pillar, and this part forms at once the inferior part of the ring and the edge of the ligament. By this croſſing of the pillars is the ring ſecured, and the more muſcle pulls in its action upon the abdominal viſcera, the tighter is the opening drawn. Through this ring the ſpermatic cord paſſes, and at the place where it paſſes the internal oblique muſcle, the latter ſends down with it a bundle of fleſhy ſibres which ſpread over it, extend to the teſticle, and are there expanded on the upper part of it.

CCCCLXXVII.

This bundle, or expanſion, is termed the cremaſter muſcle of the teſticle, which is deſigned for ſuſpending it, and drawing it up. It is ſtrong in animals, but is thin in the human ſubject, and ſometimes is hardly to be diſtinguiſhed from the teguments. It acquires thickneſs from diſeaſe of the teſticles.

The ligament of the thigh ariſes from the ſpinous proceſſes of the ilium, and is inſerted into the creſt of the pubes. The tendon of the oblique muſcle is implanted into it, and part of the fleſh of the muſcle ariſes from its outer end. By this ligament an arch is formed for the paſſage of the pſoas and internal iliac muſcles, and for the great artery of the thigh and its anterior nerve. By it alſo are returned the great vein and the lymphatics of the limb, and the inguinal glands are ſituated there. Its whole interſtice is filled with fat and cellular matter, though its texture is not firm.

CCCCLXXVIII.

Diaphragm.

The diaphragm, or midriff, is the tranſverſe partition betwixt the abdomen and the thorax. It forms a vaulted diviſion between the cheſt and belly; having alſo a conſiderable obliquity, that while its forepart is as high as the ſternum, its lower and back part ariſes from the loweſt vertebræ of the loins, near the pelvis.

CCCCLXXIX.

This muſcle is of a circular form. In its centre it is tendinous; but ariſes by fleſhy borders. It is concave below, and convex above; and when it preſſes againſt the abdominal muſcle in drawing the breath, it becomes in its form nearly plain; and when the abdominal muſcles meet, it is again puſhed back to its convex form. It ariſes by one broad attachment from all the borders of the cheſt, and thus is formed its large diviſion; while below, its origin is from the forepart of the loins by many ſmall tendinous ſlips, the union of which is termed the leſſer diviſion. To examine it more particularly, we obſerve that the upper diviſion ariſes by fleſhy indentations from the enſiform cartilage, and from the cartilages of the *7th* and all the inferior ribs on both ſides. In their courſe its fibres run in a radiated manner, and they are inſerted into a cordiform tendon placed in the middle of the diaphragm, and in which the fibres of the oppoſite ſides are interlaced. Towards the right ſide, the tendon is perforated by a triangular hole for the paſſage of the vena cava inferior, and to the upper convex part of it the pericardium and mediaſtinum are connected.

CCCCLXXX.

The origin of the leſſer diaphragm is from the ſpine, by four ſmall tendinous heads on each ſide. The firſt of theſe, or longeſt, ariſes from the ſecond vertebra above the pelvis, and adheres to the bodies of all the vertebræ of the loins above this, by the intervention of the common ligament covering the bones. In their aſcent they leave an oval opening for the paſſage of the aorta and thoracic duct. The other heads ariſe from the the third, and alſo from the ſecond lumbar vertebra, and are placed farther out. From the different heads, the muſcular fibres run upwards, and form in the middle two fleſhy columns which decuſſate and leave an opening for the paſſage of the æſophagus. It is inſerted by fleſhy fibres into the poſterior edge of the cordiform or middle tendon. Thus is the diaphragm compoſed of one great and circular muſcle before, of one ſmaller one behind, of a triangular tendon the centre between theſe muſcles, and both at its tendinous and fleſhy parts it has perforations for the large veſſels paſſing between the thorax and abdomen. The lower ſurface of the diaphragm is lined with the peritoneum or membrane of the abdomen, and the upper ſurface is covered with the pleura or membrane of the cheſt. The hole for the vena cava is ſo large, that the peritoneum and pleura meet in contact round this vein. The office of this muſcle is chiefly in breathing, and independant of the action of the ribs, it is capable of completing this function. In its natural ſtate the diaphragm is convex towards the cheſt. By its action, however, it loſes its convexity, and becomes plain. By this the thorax is enlarged, while the weight of the air unfolds the lungs, which of courſe follow the diaphragm. There is no ſpace ever between this muſcle, and the lungs, and the ribs, and the diaphragm, are cloſely encircled by them, almoſt as if they were their internal lining; and, indeed, they become ſo in ſome meaſure by forming occaſionally adheſions. The aſcent or return of this muſcle in expiration, is performed by the contraction of the abdominal muſcles, which is alternate with that of the diaphragm. By their means it yields, goes back into the thorax, and grows convex again. The gentle preſſure which all the abdominal veſſels receive from this conſtant and regular motion, cannot fail to aſſiſt in the performance of their ſeveral functions. But there are certain circumſtances in which the abdominal muſcles and the diaphragm act all at one time, and by this means the cavity of the abdomen is diminiſhed, and its contents more forcibly compreſſed. This is what takes place in parturition, in the expulſion of the fœces, and in vomiting. Beſides theſe uſes, the acts of coughing, ſneezing, ſpeaking, laughing, gaping, and ſighing could not take place without this muſcle aſſiſting, and they may be conſidered as its irregular actions. Hence, the variety of its offices may well make it deſerve to be conſidered in the language of Haller, as, *Nobiliſſimus poſt cor muſculus.* In this part, indeed, all our feelings ſeem as it were to concentrate.

CCCCLXXXI.

Muſcles of the Parts of Generation, and Parts contiguous.

The diviſion of the abdominal muſcles laſt demonſtrated is naturally followed by thoſe of the genital organs, and of the anus and perineum.

CCCCLXXXII.

Erector Penis.

The firſt is the erector penis, a ſmall ſlender muſcle paſſing over the anus, and bending it back to the pubes. It ariſes from the inner ſide of the tuberoſity of the iſchium. It runs up fleſhy, increaſing in breadth, and embracing the whole crus penis, and is inſerted by a thin tendon into the elaſtic membrane which covers the corpora cavernoſa penis as far as the union of the crura. By its action it compreſſes the crus penis, and puſhes the blood from it into the fore-part of the corpora cavernoſa in the time of its diſtenſion. It is likewiſe ſuppoſed to give a proper direction to the penis.

CCCCLXXXIII.

Accelerator Urinæ

Is a muſcle that ſurrounds all the bulb of the urethra, and acts by a ſort of jirk in diſcharging the laſt drops of the urine, and in throwing out the ſemen. It ariſes fleſhy from the ſphincter ani and the membranous part of the urethra, and tendinous from the crus and beginning of the corpus cavernoſum penis. In its courſe it forms a thin fleſhy layer, the inferior fibres of which run more tranſverſely than the ſuperior, which deſcend in an oblique direction, the muſcles on the oppoſite ſides completely encloſing the bulb of the urethra. By a tendinous line running longitudinally on the middle of the bulb, it is inſerted into its fellow. By the action of this muſcle, the urine and ſemen are propelled forward; and, by compreſſing the bulb, the blood is puſhed into, and thereby diſtends the corpus cavernoſum urethræ and glans of the penis.

CCCCLXXXIV.

Tranſverſalis Perinæi or *Penis.*

This muſcle ariſes from the inſide of the tuberoſity of the os iſchium, cloſe to the erector penis. It is inſerted into the very backmoſt point of the bulb of the urethra, where it touches the anus. Its courſe is directly acroſs the perineum, and its relation to it and the anus is more apparent than to the penis. There is often another muſcle of the ſame origin, which runs along with the former, but rather more obliquely upwards. This muſcle in its action, by bracing up the bulb to the arch, may have ſome effect in ſtopping the vein on the back of the penis, and ſo in producing erection; but its principal office muſt be to prevent the anus being too much protruded in the diſcharge of fœces, and in drawing it back when protruded.

CCCCLXXXV.

Sphincter Ani

Is a broad circular band of fibres ſurrounding the anus. Its origin is from the point of the os coccygis behind. . It runs forward within the ſkin and fat that covers the verge of the anus. It ſends out a neat ſmall ſlip, by which it is attached to the back part of the accelerator muſcle. It is of a regular oval form, and is two inches broad, being ſtronger in man than in animals. The action of this muſcle is to ſhut the anus, and alſo to pull down the bulb of the urethra, by which it may aſſiſt in throwing out the urine and ſemen.

This muſcle is ſometimes ſeen divided into two parts, an external, as demonſtrated, and an internal, which is merely the circular muſcular coat of the end of the rectum.

CCCCLXXXVI.

Levator Ani.

The levator ani is one broad thin muſcle which ariſes from the internal ſurface of all the forepart of the pelvis, and from its breadth it has been termed the broad muſcle of the anus. Its origin is by a ſemicircular edge from the os pubis within the pelvis, at the upper edge of the foramen thyroideum. It grows gradually ſmaller as it goes downwards to ſurround the anus, into the circle of which it is inſerted, into the point of the os coccygis, and is mixed with the muſcle of the ſphincter. Thus the whole pelvis is lined by it, and it has been compared to a funnel or inverted cone, the wider part repreſenting its origin, the narrower its inſertion. By this muſcle the whole bladder is ſurrounded. Through an opening in its fibres the urethra finds a paſſage. It raiſes and dilates the anus for the diſcharge of fœces, and by the ſupport it gives, prevents its protruſion. Hence, from its uſe, it is the antagoniſt of the ſphincter, and by its action it forms a ſphincter of the bladder. From the ſituation alſo of this muſcle with reſpect to the genital parts, the veſiculæ are emptied by its action, the fluid compreſſed, and as it pulls upwards at the ſame time, the back of the penis is preſſed againſt the pubes, erection maintained, and the accelerator muſcles aſſiſted by it. Under morbid irritation of any of the parts of the pelvis, from the general connections of this muſcle it is communicated by means of it to the whole of them; and hence, the uneaſy ſymptoms that are produced as a conſequence of ſympathy in theſe caſes.

CCCCLXXXVII.

Muſculus Coccygæus.

This thin flat muſcle ariſes by a narrow point from the ſpinous proceſs of the iſchium. In its paſſage it gradually expands, and is implanted into the whole length of the os coccygis. Its only office can be to draw up the point of the os coccygis, and thus to raiſe the circle of the anus. Hence it corresponds in ſome degree with the levator ani.

CCCCLXXXVIII.

Perineum.

The perineum, or beginning of the bulb, is the uniting point of all the muſcles; by the croſſing and union of which it is ſecured, and the heavy abdominal viſcera ſupported.

CCCCLXXXIX.

Having deſcribed the muſcles belonging to the genital parts of the male, thoſe of the female fall next to be demonſtrated. There are, however, only two peculiar ones, the firſt of which is the

CCCCXC.

Erector Clitoridis.

It is ſmaller than the erector penis of the male, but is implanted in a ſimilar manner into the crus and body of the clitoris.

CCCCXCI.

Sphincter Vaginæ.

The other muſcle is the ſphincter vaginæ. It ariſes from the ſphincter ani, and from the poſterior ſide of the vaginæ, near the perineum. It paſſes along the outer end of the vagina, covers the corpus cavernoſum vagina, and going behind the nymphæ, it is inſerted into the union of the crura clitoridis. By its action, the external ſurface of the vagina is contracted by compreſſing its corpus cavernoſum, from which laſt it alſo puſhes the blood into the nymphæ and clitoris.

CCCCXCII.

Muſcles of the Inferior Extremity.

To finiſh the deſcription of the muſcles, thoſe of the inferior extremity ſtill remain, which are divided into thoſe of the thigh, leg, and foot.

CCCCXCIII.

Muſcles of the Thigh.

All the muſcles of this part take their origin from the pelvis or trunk; and, previous to their deſcription, it is proper to notice the tendinous expanſion, or faſcial ſheath, in which they are involved. This part, ſimilar to what occurs in the arm, forms a general covering to the muſcles, and ſends off partitions between them, in which they are incloſed, which give them ſtrength and ſupport in their exertions. Above, it adheres to the outer top of the os innominatum, and communicates with the tendon of the external oblique; lower down, it ſpreads itſelf over the joint of the knee, and from thence it paſſes on to the leg. In its progreſs it is always receiving additions at different places. On the outſide of the thigh and leg it is of great ſtrength and thickneſs, but towards the inner ſide of both, particularly the former, it gradually turns thinner, and has rather the appearance of cellular membrane. A little below the great trochanter it is firmly connected to the linea aſpera, and at the joint of the knee it receives additions from the tendons of the extenſors of the leg, and is there connected with the outer and inner heads of the tibia and fibula. In the leg it is firmly fixed to the ſpine of the tibia, and at the under end to the bones of the ankle, where part of it is thicker and ſtronger than the reſt, and forms the annular ligament of the tarſus. It is loſt at laſt upon the foot.

CCCCXCIV.

The connections of this ſheath, from the deſcription given, are numerous. They begin at the creſt of the ilium, at the ligament of Poupart, and at the creſt and arch of the pubes. They come on to the tuber iſchii, and back, along the coccyx, to the ridge and proceſſes of the ſacrum. They are then connected with the ligament of the joint, the great trochanter, and the linea aſpera all the way down to the knee, where its laſt adheſion is very ſtrong, and where it receives additional layers.

CCCCXCV.

Facialis.

The facial muſcle is the firſt of this part to be demonſtrated. It is properly the tenſor vaginæ femoris. It ariſes by a narrow beginning from the upper ſpinous proceſs of the ilium, by means of a tendon an inch in length. It is equally narrow at its inſertion, a little below the great trochanter into the inner ſurface of the aponeurotic covering. Its chief office is to tighten the faſcial covering, and prepare the muſcles for ſtrong action. It may, perhaps, alſo, have ſome effect in rolling the thigh, and turning the toes inwards.

CCCCXCVI.

Pſoas Magnus

Is a large round muſcle, filling up all the ſpace upon either ſide of the ſpine, and at its ſide bounding the pelvis. It ariſes from under the ligamentum arenatum of the diaphragm, from the laſt vertebra of the back, and ſucceſſively from each of the vertebræ of the loins. It is inſerted into the ſacro iliac ſymphyſis, and along with the internal iliac muſcle it deſcends through Poupart's ligament. The action of this muſcle is to move the thigh forwards; it is of conſtant uſe for this purpoſe, or to ſupport the pelvis upon the thigh bone.

CCCCXCVII.

Pſoas Parvus.

This is a muſcle of the loins. It ariſes fleſhy from the laſt vertebra of the back, and one or two upper vertebræ of the loins. It ends in a ſlender tendon which runs down by the ſide of the pſoas magnus, and ſtops ſhort within the pelvis, being inſerted into the os ilium, near the place of the acetabulum. This muſcle is ſometimes wanting in both ſexes, but oftener in men than in women. In ſome caſes, three muſcles of this name are met with. The uſe of this muſcle is to aſſiſt in bending the ſpine upon the pelvis, or in raiſing the pelvis.

CCCCXCVIII.

Iliacus Internus.

The whole concavity of the ilium is the ſeat of this muſcle. Its origin is from the tranſverſe proceſs of the laſt lumbar vertebra, from all the edge of the iliac ſpine, from the forepart of the bone under the ſpinous proceſs, and from a part alſo of the capſular ligament of the joint. At Poupart's ligament its fibres form a tendon. This tendon is larger at the lower than upper ſurface, gliding on the pubes, and connected only by looſe cellular ſubſtance. It is implanted into the leſſer trochanter. The action of this muſcle is to aſſiſt the pſoas in bending the thigh. They are both muſcles of great power. Along with them the large blood veſſels deſcend, and they are all covered with looſe cellular ſubſtance.

CCCCXCIX.

Pectinalis.

This is a broad ſquare muſcle ariſing at the pubes, and lying along ſide of the laſt, having its inſertion along with their tendon. Its origin is from the anterior edge of the os pubis, and it is inſerted by a long flat tendon into the linea aſpera, at its upper and forepart. The uſe of this muſcle is to bend the thigh bone, and cloſe the knees together. It likewiſe aſſiſts in rolling the thigh bone outwards.

D.

Triceps Femoris

Ariſes from the pubes with three heads, which are ſo much unconnected, as to be commonly deſcribed as three ſeparate muſcles, under the names of the abductor primus or longus; the ſecundus or brevis, and the tertius or magnus.

The *1ſt* is the uppermoſt flat layer which ranges with the border of the pectinalis. Its origin is by a ſtrong roundiſh tendon from the upper and fore part of the pubes, and running downward and outward, it has its inſertion by a broad flat tendon into the line of the linea aſpera at its middle. Thus the muſcle is of a triangular form with its baſe in the linea aſpera, and its apex on the pubes.

The *2d*, or brevis, ariſes at the ſide of the ſymphyſis pubis, below and behind the former by a thick flattened tendon, and it is again inſerted by a ſhort one into the inner trochanter and linea aſpera. Its difference from the former is in being leſs oblique, and going more immediately acroſs.

The *3d*, or magnus, ariſes alſo from the ſide of the ſymphyſis pubis, a little lower than the former. It is long and flat, and is the moſt internal of the three. Its origin is broad, and its termination is implanted into the thigh bone the whole length of the linea aſpera, which gives its fibres various degrees of obliquity. By this muſcle a flat partition is formed betwixt the fore and back parts of the thigh. The great artery is alſo perforated by it to get from the fore to the back part of the thigh, and down into the ham.

The action of theſe three muſcles is the ſame. To bring the thigh inwards and upwards, according to the different direction of their fibres, and to aſſiſt a little in rolling the thigh outwards, in doing which they poſſeſs great power from the diſtance of their origins from the centre of the bone which they move.

DI.

Obturator Externus

Takes its name from the ligament that forms its origin and which ſhuts up with the muſcles the thyroid hole. It ariſes from the ramus of the iſchium and pubes by a ſemicircular margin, and is a ſhort conical muſcle, with a broad origin and narrow inſertion. This inſertion is into the cavity at the inner and back part of the root of the trochanter major; and, by the tendon twiſting as it were under the thigh bone, it is in a manner rolled round it. Its chief action appears to be rotation, and it likewiſe prevents the capſular ligament from being pinched in the motions of the joint.

DII.

Glutæi.

Under this name are included three muſcles which help to form the buttocks on each ſide. They are diſpoſed in layers under each other, and each ſmaller than the one that covers it.

DIII.

The firſt is the glutæus maximus, which is a broad radiated muſcle ariſing from the back part of the ſpine of the ilium, from the under and outer part of the ſacrum, or all its ſpines, and from the ſacroſciatic ligament. Its fibres proceed in a winding direction down the thigh till gathered into a flat thick tendon, which is inſerted into the upper and outer part of the linea aſpera, along which it continues for ſome way down. This muſcle is conſidered as one of the largeſt of the body, and by it is formed the contour of the hip. Its action is to pull the thigh directly backwards, or the body forward upon the thigh when the thigh is fixed; and, in doing this, its different parts act with different effect, according to their direction, and the particular poſition of the pelvis. By its origin from the coccyx, that bone is prevented from being forced too far backwards.

DIV.

Glutæus Medius.

The ſecond muſcle is the glutæus medius, reſembling in its ſhape the former. It ariſes from the ſpine and ſuperior ſurface of the ilium not occupied by the former muſcle. It poſſeſſes a radiated or converging form, and is gathered into a ſhort flat tendon which is inſerted into the outer and back part of the great trochanter. The uſes of this muſcle correſpond with the former. Its proper office is to aſſiſt in pulling the thigh backwards, and moving it outwards from the body; but, as certain portions of it lie alſo before the thigh bone, theſe may have an effect in pulling it forward.

DV.

Glutæus Minimus.

This ſmall radiated muſcle lies deep under the former, in older ſubjects having its outer ſurface uſually tendinous. It ariſes from the lower half of the dorſum of the os ilium, which is continued to the great ſciatic notch, when it is gathered into a ſtrong flat tendon, and inſerted into the upper and fore part of the great trochanter. This muſcle aſſiſts the two former in drawing the thigh backwards and outwards, and in rolling it. It may ſerve likewiſe to prevent the capſular ligament from being pinched on the motions of the joint.

DVI.

The glutæi muſcles then are placed in a regular ſucceſſion; the great glutæus is inſerted below the root of the trochanter, and into the linea aſpera;

the middle one into the back and top of the trochanter, and the ſmall one into the rough part under the root of it.

DVII.

Gemini.

This ſimple bicipital muſcle, from the diſtinctneſs of its heads, has been generally deſcribed as two, under the name of gemini.

The upper one, the longeſt and ſtrongeſt, ariſes from the ſpinous proceſs of the os iſchium, and the ſmall one from the tuber or ball on the outer end of the ſame bone. In their courſe they are fleſhy, and meeting at laſt, they unite their tendons in the great trochanter, at the root of which proceſs they are firmly inſerted. Their action is to roll the thigh outwards, and to prevent the tendon of the obturator internus from ſlanting from its muſcle while the muſcle is in action.

DVIII.

Pyriformis.

This muſcle, named the internal iliac and pyramidalis, proceeds from the hollow of the ſacrum, riſing by three tendinous and fleſhy heads from its 2*d*, 3*d*, and 4*th* pieces. As it paſſes out of the pelvis, it becomes round and tapering, and is inſerted into a cavity at the inner ſide of the root of the great trochanter. Its chief action is to aſſiſt in rolling the thigh outwards, and in moving it a little upwards. Its name is derived from its ſhape.

DIX.

Obturator Internus

Is a conſiderable muſcle, the chief part of which is ſituated within the pelvis. It ariſes within this cavity by a ſemicircular fleſhy margin from the anterior half of the thyroid hole, and in part from the obturator ligament. Its fibres converge and ſend off a round tendon which paſſes over the os iſchium, in the manner of a rope over a pulley, between the ſpine and tuber of that bone. Its tendon is joined as it paſſes between the two legs of the gemini to theirs, and it is inſerted along with the gemini into the root of the great trochanter. By its action this muſcle rolls the thigh obliquely outwards, by pulling it towards the ſacroſciatic niche.

DX.

Quadratus Femoris.

This thin flat muſcle paſſes in a tranſverſe direction betwixt the tuber iſchii and the thigh bone. It ariſes from the tuber iſchii at its low flattened ſurface, and proceeding ſomewhat obliquely upwards and outwards, it is implanted into the back of the great trochanter, in the roughneſs [illegible]ng it to the bone. The office of th[illegible]e is to bring the os femoris out-

DXI.

The muſcles of the thigh, we find, are ſtrong and varied in their motions. Their ſtrength is neceſſary from their ſituation in ſupporting the body; and, from the mode of their inſertion, which is only the two points of the trochanter, none of their motions can be direct, and a chief part of the muſcles bends round the thigh bone to get at the place of their inſertion; one half on the outſide of it, and the others on the inſide. The firſt are termed abductors, and pull it outwards; the ſecond are termed adductors, and draw the thighs together.

DXII.

Muſcles of the Leg.

The actions of the leg being merely thoſe of flexion and extenſion, its muſcles are ſimple, and they are divided accordingly into two claſſes, of flexors and extenſors.

DXIII.

Rectus Femoris.

The firſt of the extenſors is the extenſor femoris or rectus cruris, ſo named from its direction, being a flat thin muſcle, ariſing by two heads. The firſt and ſhorteſt head proceeds from the outer ſurface of the inferior and anterior proceſs of the ilium; the poſterior tendon, which is thicker and longer than the other, ariſes from the poſterior and outer edge of the cotyloid cavity, and from the adjacent capſular ligament. Theſe heads joining together, form a flat tendon of four inches in length, which gradually enlarges and becomes fleſhy to its middle, when it contracts towards the patella in the ſame gradual manner. On the back part of this muſcle there is a middle tendinous line, very conſpicuous, and towards it, as a centre, all the muſcular fibres converge. The action of this muſcle is to extend the leg, and it is united at its ſides to the vaſti, and at the back part to the cruræus.

DXIV.

Rectus Cruris.

The rectus cruris is compoſed of three great muſcles, the cruræus, and the two vaſti, that inwrap the whole of the thigh bone.

DXV.

Cruræus.

The firſt, or cruræus, is ſituated under the rectus and between the vaſti. It ariſes from the fore part of the trochanter minor, and continues its progreſs down till within two inches of the patella, when it is joined by the vaſtus externus. At its lower part it is joined by the tendon of the rectus, and both muſcles form one large one inſerted into the rotula.

Upon this muſcle are ſometimes found two ſmall ones, which ariſe from the anterior ſurface of the os femoris, two or three inches above the capſular ligament of the knee joint, into which they are inſerted on each ſide of the patella. When theſe muſcles are wanting, ſome of the fibres of the cruræus are ſpread over the capſula. Where they appear, they are inſerted into the capſule on each ſide the patella, and their action is evidently intended to prevent its being catched. The office of the cruræus is to extend the leg, and to aſſiſt the other in doing this.

DXVI.

Vaſtus Externus

Is a large thick fleſhy muſcle on the outſide of the thigh. It ariſes by a broad thick tendon from the outer root of the trochanter major. It is continued from the trochanter along the whole outer ſide of the linea aſpera to near the outer condyle of the os femoris, by fleſhy fibres which run obliquely forwards to a middle tendon. In the middle of its courſe it adheres to the anterior ſurface and outer ſide of the cruræus, with which it continues to be connected to the lower part of the thigh, where it is ſeen terminating in a broad tendon which is inſerted into the upper part of the patella laterally, and ſends off an aponeuroſis that adheres to the head of the tibia, and is continued down to the leg. The action of this muſcle is to aſſiſt in extending the leg.

DXVII.

Vaſtus Internus.

This muſcle is neither ſo large nor fleſhy as the former. It is ſituated at the inner ſide of the thigh, being ſeparated from the laſt one by the rectus. It ariſes from the fore part of the trochanter minor. It is continued along the whole inſide of the linea aſpera, by fibres running obliquely forwards and downwards, and it is inſerted into the upper and inner part of the patella, continuing fleſhy lower down than the former muſcle; nor does this complete its inſertion, it is even in part extended down in an aponeurofis, and fixed to the upper part of the tibia. By this muſcle is formed the fleſhy cuſhion that covers the inſide of the knee joint. The action of this muſcle concurs with the two former in extending the leg, in doing which, the patella is fixed to the tubercle of the tibia by a ſtrong ligament, and ſupplies the office of a pulley.

DXVIII.

By theſe three muſcles, alſo, a large maſs of fleſh is formed, which incloſes all the thigh bone, and they are ſo connected that the cruræus cannot be ſeparated from them. The conjoined power of theſe muſcles cannot fail to be very great; a power increaſed by the pulley-like advantage of the rotula, which extends their action, and fits them for being uſeful in certain ſituations; and, by its attachment to the tibia, it is rendered capable of ſuſtaining the force of theſe muſcles.

DXIX.

FLEXORS OF THE LEG.

Sartorius.

The taylor's muſcle receives its appellation from bending the knees and drawing the legs acroſs. It is a flat ſlender muſcle, the longeſt in the body, and from 1½ inch to 2 inches in breadth. It extends obliquely from the upper and anterior part of the thigh to the upper anterior and inner part of the tibia, being incloſed by a thin membranous ſheath. Its origin is from the upper ſpinous proceſs of the os ilium, by a tendon about ½ inch in length, and it is inſerted into the inner tubercle of the head of the tibia. This muſcle ſerves to bend the leg obliquely inwards, or to roll the thigh outwards, and alſo to bend the leg upon the knee; all which actions it ſhews in performing that one which gives it its name. From its diſtance from the centre of motion, though ſmall, it is naturally a muſcle of ſtrong power.

DXX.

Gracilis.

This muſcle is named alſo the rectus internus femoris. It is a ſmall flat muſcle, ſomewhat reſembling the former. Its origin is by a ſhort flat tendon near the ſymphyſis pubis, and it paſſes immediately under the integuments down to the knee. It paſſes by the inner condyle of the knee in a round tendinous form, and it is bound by tendon, as it bends behind the head of the tibia. It is inſerted with the ſartorius into the ſide of the tuberoſity at the top of the tibia. This muſcle ſerves chiefly as a flexor of the leg, and aſſiſts the former in making the full flexion of the knee after it has been bent to a certain degree by the flexors on the back part of the thigh. Like the former muſcle, by its diſtance from the centre of motion, its power is very great.

DXXI.

Semi-tendinoſus

Is ſo named from its under half, being compoſed of ſmall round tendon. It ariſes from the poſterior part of the tuberoſity of the os iſchium. Its fleſhy belly runs down the back part of the thigh, and ſends off a long roundiſh tendon which paſſes along the inner ſide of the knee, and ends flat. It is inſerted into the inſide of the ring of the tibia, a little below the tubercle, and is connected to the under edge of the gracialis. This muſcle aſſiſts in bending the leg, and at the ſame time draws it a little inwards.

DXXII.

Semi-membranoſus

Has its appellation from its origin, which is from the outer ſurface of the tuberoſity of the iſchium by a broad flat tendon. It then grows fleſhy and thick in its middle, and turns thinner again, till it terminates in a ſhort tendon which glides behind the head of the tibia to be inſerted there.

This muſcle, with the former, compoſes the hamſtrings, by which another motion is acquired when we ſit with our knees bent; for, in this poſition, by means of theſe muſcles, a ſlight rolling of the tibia is procured, while its chief action is to bend the leg and bring it directly backwards.

DXXIII.

Popliteus.

This muſcle is named from its ſituation in the ham. It is of a ſmall triangular form, lying acroſs the back part of the knee joint, very deep under the hamſtrings and muſcles of the legs. Its origin is by a ſmall round tendon from the outer and under part of the external condyle of the os femoris, and from the back part of the capſular ligament of the joint. In paſſing the joint it becomes fleſhy, ſpreads out, and its fibres run obliquely inwards and downwards. It is inſerted into a ridge at the upper and inner edge of the tibia, a little below its head. By the action of this muſcle the leg is bent, and when bent, rolled inwards. It prevents, alſo, the capſular ligament, by pulling it aſide, from being pinched.

DXXIV.

Biceps Cruris,

So named from its two heads, lies in the back part of the leg, running down from the pelvis to the knee, in order to compoſe the outer hamſtrings. It ariſes by two heads, which afterwards unite to form one muſcle. The firſt, or long head, ariſes in common with the ſemi-tendinoſus from the upper and back part of the tuberoſity of the os iſchium. The ſecond, or ſhort head, ariſes from the linea aſpera, a little below the termination of the glutæus maximus, by a fleſhy acute beginning, which ſoon grows broader as it deſcends to join the firſt head, a little above the external condyle of the os femoris. The inſertion of this muſcle ſurrounds the head of the fibula, and a ſmall portion of it is alſo implanted into the tibia. This muſcle bends the leg, which is the extenſive office of its ſhort head, but beſides this, its long head is alſo a muſcle of the thigh.

DXXV.

Having thus demonſtrated the muſcles of the thigh and leg, we ſhall next examine the motions performed by them. Thus, if we fix the leg, the muſcles that commonly move it act upon the thigh and the trunk, and this is one reaſon why Nature has not furniſhed them merely from the thigh bone, but alſo from the trunk; or, if we act with the longeſt muſcles of the leg, which come from the trunk of the body on one ſide, and with thoſe that come from the thigh only of the other, the firſt are now made muſcles of the thigh.

DXXVI.

The moſt common office of the muſcles deſcribed, is walking. Suppoſe, then, that a perſon reſts equally on both heels, and that he means to make a ſtep forwards, the firſt thing neceſſary is to draw the weight of the leg which he intends to move, ſuppoſe it the left one. This is done by acting with the muſcles of the oppoſite ſide, ſo as to turn the trunk over; and if we throw into action the abdominal muſcles, this motion is made. At the ſame time, we fix the pelvis not only by the weight on that ſide, but by the abductors of the thigh brought into action, which pull the pelvis over when the thigh is fixed by the weight. Thus the weight is thrown over upon the right leg, and we ſtand upon it. By ſtanding perpendicular upon the right leg, and the left having a ſlanting direction, the heel is neceſſarily raiſed from the floor, and now fixing the right leg, we begin to raiſe the left, for which purpoſe are employed firſt the flexors of the thigh, the pſoas magnus and iliacus internus, which bend the thigh and draw it up; we, at the ſame time, generally bend the leg a little, and by thus bending the thigh and leg, room is afforded for giving it the ſwing forwards. If we are ſtraight upon the right leg, and the other is in the ſlanting direction, the ſole cannot touch the ground; and, in order to do this, we muſt allow the joints of the right one to bend gently. We now mean to throw the weight forwards, and by degrees to bring it from the right to the left; firſt, by bending the trunk itſelf, for which we employ the pſoas magnus and iliacus internus as before, but on the right ſide. Theſe now draw forwards the trunk, as being more moveable, and they ſupport the action of the trunk by the abdominal muſcles, while thoſe of the neck bring forwards the head. At the ſame time we mean to raiſe the thigh forwards upon the leg, and to puſh the weight ſtill farther forwards. We employ the extenſion of the right leg, and as the leg is more fixed than the thigh, the muſcles move the thigh and the whole trunk forwards. By theſe means the weight is thrown more and more forwards, but ſtill not ſufficiently, we want ſtill more weight upon the left leg. To this we firſt employ the gaſtrocnemii muſcles, (not yet deſcribed); and, as the legs cannot be bent downwards, the muſcles muſt be ſhortened, ſo the heel is raiſed; and, of courſe, the tibia, the leg, and the whole body upon it is thrown forwards. As ſoon as we are ſenſible that the weight is thrown ſufficiently upon the left leg, to fix more than the trunk, we now begin to employ the muſcles of the right leg in pulling it forwards, and the whole of the weight falls perpendicular upon the left leg. To make another ſtep with the right, we do the ſame thing as before, only we give the leg a greater ſwing, after which, all the other actions are repeated in the ſame manner.

DXXVII.

Running is little more than walking quickly, keeping the legs almoſt perpendicular to the ſockets of the oſſa innominata. If we mean to make a more violent exertion of jumping, we bend the joints in order to ſtretch the muſcles, whereby, when we come to throw the energy into them, they make a greater preſſure againſt the ſeveral bones and againſt the earth; and, as the re-action is equal to the preſſure, the body is thrown upwards.

DXXVIII.

Muſcles of the Foot.

To finiſh the deſcription of the lower extremities, the muſcles of the foot ſtill remain; and theſe are divided into extenſors and flexors.

DXXIX.

Gaſtrocnemius.

The firſt of the extenſors is the gaſtrocnemius, which admits a diviſion properly into two parts, and is the great muſcle of the brawn.

DXXXIV.

Peronæus Longus.

The peronæus longus ariſes tendinous and fleſhy from the fore part of the head of the fibula, and fleſhy from the outer part of the bone to within a hand breadth of the ankle. Its fibres run in a penniform manner towards a long tendon which begins very high about the middle of the leg. It is ſeen immediately under the teguments as it deſcends, being that acute line or ſtring, which running down behind the inner ankle, gives ſhape to that part. At the ankle it paſſes through a cartilaginous groove in common with the peronæus brevis, being bound down by the annular ligament. When it has reached the os calcis, it quits the tendon of the peronæus brevis, and runs obliquely inwards along a groove in the os cuboides, under the muſcles on the ſole of the foot, to be inſerted into the outſide of the poſterior extremity of the metatarſal bone of the great toe. This muſcle is a powerful extenſor of the leg, and gives that obliquity to the foot which gives it figure and utility in walking. It turns down to the ground the inner edge of the foot, by preſſing to the ground the great ball of the toe, and is that part which feels ſenſibly painful on walking. Hence, its offices are to extend the foot a little, to draw it outwards, and to turn the inner edge of it downwards.

DXXXV.

Peronæus Brevis

Differs from the former chiefly in the two circumſtances of length and inſertion. Its origin is from the edge of the fibula, its fibres continuing to adhere to the lower half of that bone. Its round tendon paſſes through the groove in the malleolus externus, along with that of the former muſcle; after which, it runs in a ſeparate groove to be inſerted into the upper and poſterior part of the tubercle at the baſe of the metatarſal bone that ſupports the little toe. This muſcle aſſiſts the former in extending the foot, and coincides with it, by turning the outer edge of the foot upwards.

DXXXVI.

Tibialis Poſticus.

This penniform muſcle is ſituated behind the tibia and fibula, and between the two laſt muſcles. It ariſes from the back part and ridge of the tibia, from the oppoſite part of the fibula, and from the interoſſeous membrane, continuing its attachment to the latter quite down to the ankle. Its fibres are all oblique, and paſs to its middle tendon in the heart of the muſcle. This tendon in its deſcent becomes round, and paſſes in a groove behind the malleolus internus. It is inſerted into the upper and inner part of the os naviculare, and partly into the under ſurface of the tarſal bones by ſeparate ſlips, the laſt of which goes to the root of the metatarſal bone of the middle toe.

This muſcle pulls the foot ſo as to put the toes together; and, when balanced by the peronæi, it directly bends the foot.

DXXXVII.

Tibialis Anticus

Croſſes obliquely the fore part of the leg. It ariſes from the fore and outſide of the tibia, between its tubercle and the articulation of the fibula. It deſcends on the outſide of the tibia, till it reach the under part of the leg, when it ſends off a ſtrong round tendon which paſſes the under part of the annular ligament, near the ankle. It is inſerted by tendon into the middle of the cuneiform bone, and the baſe of the metatarſal bone of the great toe. Its office is to bend the foot by bringing the fore part of it towards the leg.

DXXXVIII.

MUSCLES OF THE TOES.

The long muſcles of the toes are only four in number, two flexors, and two extenſors; and they lie under the laſt muſcle, or keep in their courſe very near it.

DXXXIX.

Flexor Longus Pollicis.

The firſt of the flexors ariſes ſmall and pointed at its origin from the back part of the fibula, ſome way below its head. It grows thicker and larger as it deſcends, and a little above the heel it terminates in a round tendon; which, after paſſing in a groove formed at the poſterior edge of the aſtragulus, and the internal lateral part of the os calcis, on which it is ſecured by an annular ligament, goes to be implanted into the laſt bone of the great toe. The office of this muſcle is to bend the great toe, to keep it firm to the ground, and to extend the foot while the heel is raiſed by the gaſtrocnemii.

DXL.

Flexor Longus Digitorum

Is ſituated along the poſterior part and inner ſide of the leg. It ariſes from the back part of the tibia its whole length to within three inches of the ankle. Its tendon then paſſes down under a head of annular ligament, and through a ſinuoſity at the inſide of the os calcis. It then, ſoon after, receives a ſmall tendon from the former muſcle, and about the middle of the foot divides into four tendons, which paſs through the ſlits of the flexor digitorum brevis, and are inſerted into the upper part of the laſt bone, or third phalanx of the four leſſer toes, being incloſed upon the toes by annular ligaments. By the action of this muſcle all the joints of the toes are bent, but particularly the laſt one. The foot is alſo extended, and the point of the toes kept to the ground.

DXLI.

Plantaris Pedis.

This is a ſmall body of fleſh naturally connected with the laſt muſcle. It ariſes in two diviſions from the lower part of the heel bone, and is pretty nearly of a ſquare form. It joins the tendon of the laſt muſcle before its diviſion for each toe; and, from its long lever upon the heel bone, it muſt greatly aſſiſt the flexor. It is properly a ſupplementary muſcle, and has been variouſly conſidered by anatomiſts.

DLXII.

Flexor Brevis.

The flexor brevis, or perforatus, ariſes from the under and fore part of the os calcis, and from the aponeuroſis plantaris. It ſoon forms a thick belly, and divides into four portions; each of theſe portions terminates in a flat tendon, the fibres of which decuſſate to afford a paſſage to a tendon of the flexor longus; and afterwards re-uniting, they are inſerted into the ſecond phalanx of each of the leſſer toes. The proper uſe of this muſcle is to bend the firſt and ſecond joints of the toes, but particularly the ſecond, and the obliquity of the long flexor is balanced by a correſponding obliquity in this ſhort one; while, in conſequence of this obliquity, their power as muſcles is increaſed.

DXLIII.

Lumbricales.

Theſe muſcles, in their ſhape, ſituation, and number, reſemble the lumbricales of the hand. They riſe like them in the forks of the extenſor tendons, and paſs through the digitations of the aponeuroſis. They terminate in four ſlender tendons, which, after running over the inſide of the firſt joint of the four leſſer toes, are inſerted into the expanſion that is formed by the extenſor tendons, and covers the upper part of the toes. Their uſe is evidently to bend the firſt joint of the toes, and to draw them towards the great one, making an arch over the foot, and thus aſſiſting the tranſverſalis pedis.

DXLIV.

From the demonſtration of the muſcles of the foot, we obſerve that the extenſor brevis is ſituated ſuperficially in the ſole; that the plantaris pedis lying deep, ariſes from the tip of the heel, and is inſerted into the flexor longus; that the lumbricales ariſe from the ſame muſcle where the plantaris ends. Thus the lumbricales are the flexors of the firſt joint, the flexor brevis of the ſecond, and the flexor longus of the third, or laſt.

DXLV.

EXTENSORS OF THE TOES.

Extenſor Longus Digitorum Pedis.

This is a muſcle of difficult diſſection, ſituated along the anterior and outer part of the tibia, and ariſing by a thin narrow beginning from the ſame part of that bone, cloſe to the origin of the peronæus longus, from the interoſſeous ligament, and from the inner edge of the fibula, to which it continues to adhere its whole length. Many of its fibres are derived alſo from the adjacent tendinous faſcia. It terminates in a long tendon, which paſſing under the annular ligament of the tarſus, ſplits into four portions, which are inſerted into the root of the firſt joint of each of the ſmall toes, and expand on their ſurface to the root of the laſt. The uſe of this muſcle is to extend the toes; and alſo, by the expanding of its tendon, to ſeparate them from each other.

DXLVI.

Peronæus Tertius.

This is the name of a muſcle ſituated on the anterior, inferior and outer part of the leg. Its origin is from the middle of the fibula, in common with the extenſor longus. It proceeds down to near its inferior extremity, and ſends off fleſhy fibres forwards to a tendon which paſſes under the annular ligament. It is inſerted into the root of the metatarſal bone of the little toe. Its uſe is to aſſiſt in bending the foot, and preſſing down the edge or the ball of the great toe to the ground.

DXLVII.

Extenſor Digitorum Brevis.

This muſcle is placed exactly where the buckle lies, having its origin from the heel bone, and running obliquely inwards. It ariſes from the outer and fore part of the os calcis. It ſoon forms a fleſhy belly, which is divided into four portions that ſend off an equal number of tendons. Theſe ſend off an equal number of tendons, which paſs over the upper part of the foot, croſſing under the tendons of the former muſcle, and they are inſerted by four ſlender tendons into the tendinous expanſion from the extenſor pollicis, which covers the great toe, and into the tendinous expanſion from the extenſor longus, which covers all the toes but the little one. The action of this muſcle is to aſſiſt in the extenſion of the toes, and its obliquity counteracts that of the long one; while, by its expanſion, it ſpreads the toes, and pulls them from the great one.

DXLVIII.

Extenſor Pollicis Proprius.

This is a ſlender muſcle that runs from the top of the leg to the ſecond joint of the great toe. It ariſes from the upper and anterior part of the ſibula, a little below the head of that bone, to the anterior ſurface of which, and to the interoſſeous ligament, it adheres for five or ſix inches. Its fibres run obliquely downwards, and forms a tendon which paſſes under the annular ligament, from whence it runs obliquely to be inſerted into the ſecond joint of the great toe.

DXLIX.

MUSCLES OF THE FOOT.

The muſcles of the foot are few in number, and much reſemble thoſe in the hand.

DL.

Abductor Pollicis.

The origin of this muſcle is from the knob of the os calcis, and likewiſe from the ſame bone, where it unites with the os naviculare. About the middle of the metatarſal bone it terminates in a tendon; which, after paſſing over the internal ſeſamoid bone, is inſerted into the root of the firſt joint of the great toe. The uſe of this muſcle is to pull aſide the toe, and give it a little bend. The foot is alſo curved by it.

DLI.

Flexor Brevis Pollicis.

The ſituation of this muſcle is immediately on the metatarſal bone. Its origin is by a long tendon from the heel bone, and by two ſeparate ſlips from the os cuneiforme externum. It is inſeparably united with the abductor and adductor pollicis, and it is inſerted into the external ſeſamoid, and the root of the firſt bone of the great toe. The uſe of this muſcle is to bend the firſt joint of the great toe.

DLII.

Adductor Pollicis

Is the laſt portion of the muſcle that encircles the great toe. It ariſes by a long thin tendon from the under part of the os calcis, from the ligament extended betwixt the heel and cuboides, from the external cuneiform, and the root of the metatarſal of the ſecond toe. It is divided into two fleſhy heads, which meeting, go obliquely inwards, and are inſerted into the ſeſamoid or firſt bone of the great toe. The uſe of this muſcle is to pull the great toe towards the reſt.

DLIII.

Transverſalis Pedis.

This is a ſmall muſcle extending acroſs the foot at the head of the metatarſal bones. Its origin is from the ligament which joins the metatarſal bones, and its ſmall muſcular belly is inſerted into the tendon of the adductor pollicis. By its action, the heads of the metatarſal bones are drawn together, ſo that it forms a moveable ſupport for theſe parts, varying the degree of it according to circumſtances.

DLIV.

Abductor Minimi Digiti

Is a long ſlender muſcle on the outſide of the foot. It ariſes from the tuberoſity of the heel bone, from the root of the metatarſal bone of the little toe, and alſo from the aponeuroſis plantaris. It runs along the metatarſal bone, and terminates in a tendon to be inſerted into the root of the firſt bone of the toe. By this means its action is the ſame as the other flexors. It bends the little toe, and carries it outwards; and it extends and ſupports the tarſus.

DLV.

Flexor Brevis Minimi Digiti

Is a ſmall muſcle, reſembling the former in place and uſe. Its length is that of the metatarſal bone of the little toe, from which, or the ligament of the os cuboides, it ariſes, and is inſerted by a ſhort tendon into the root of the firſt bone of the little toe. Its office is to bend the toe.

DLVI.

Interoſſei.

Theſe ſmall muſcles, from their ſituation between the metatarſal bones, reſemble thoſe of the hand, and are divided like them into the external and internal.

DLVII.

Internal.

The internal ones are three in number, and ſituated in the plantaris pedis. They ariſe from the baſis and inſide of the metatarſal bones, and they terminate in a tendon that runs to the inſide of the firſt joint of theſe toes, and from thence to their upper ſurface, where it loſes itſelf in the tendinous expanſion from the extenſors. Their uſe is to draw the particular toe into which each of them is inſerted towards the great toe.

DLVIII.

External.

The external interoſſei are four in number, and from their double heads, they have been termed bicipites. They ariſe from the outſide of the root of the metatarſal bone of the fore and great toes; and they are inſerted into the inſide of the root of the firſt bone of the fore toe.

The internal interoſſei occupy the ſole of the foot, while the external appear on both ſides of the foot. Their office is all to aſſiſt in extending the toes.

DLIX.

Aponeuroſis Plantaris.

From the great expoſure of the palm and ſole to injury, beſides their muſcles, they are defended by a thick tendinous aponeuroſis. The plantar aponeuroſis ariſes from that part of the tuberoſity of the os calcis upon which we ſtand. It is divided into three portions, which run forwards to be connected to the heads of the metatarſal bones of all the toes; and, for that purpoſe, they expand as they proceed, and their fibres acquire a radiated form. The upper part therefore is thicker, and the under thinner. The middle portion is ſubdivided again into five ſlips, which ſplit at the roots of the toes, and embrace the tendons of the flexor muſcles.

DLX.

The uſes of this aponeuroſis are important. It firſt protects all the parts that lie under it. It performs the office of a ligament, by binding the two ends of the arch of the foot together. It aſſiſts the muſcles by confining them in their actions. It alſo gives origin to ſeveral of them, and it forms proper openings or rings for the other tendons to paſs through.

DLXI.

Chemical Analyſis of the Muſcles.

The analyſis of the muſcles is properly the analyſis of the ſoft parts of the animal ſtructure. For a muſcle is a compound matter, and conſiſts of membrane, veſſels and nerves, beſides the real irritable fibrous ſtructure which conſtitutes its fleſh. When ſubjected to boiling, this muſcular part or fleſh reſolves into fibrous gluten and extractive matter. The fibrous gluten, when waſhed with water, is white, inſipid, and elaſtic, reſembling much the gluten of vegetables; and, when heated with nitric acid, gives out azotic gas. When perfectly boiled, it is without ſmell, taſte, or colour. The extractive matter, again, is the proper juice of the fleſh, and gives colour, ſmell, and taſte to the fluid. It alſo forms a brown cruſt on the ſurface of roaſted meat, which gives to it the agreeable taſte and ſmell of burnt ſugar. The phoſporated calx and ſoda, are the ſalts contained in it.

DLXII.

The conſtituent parts of theſe two principles, are animal jelly and gluten.

Animal jelly is an elaſtic juice, ſoluble in water, and filling up all the interſtices in the ſoft and hard parts. In the fluid ſtate it forms broth, and in the dry ſtate glue.

DLXIII.

This ſubſtance poſſeſſes no taſte; it is ſoft and inſipid, and of a whitiſh colour. By cold, its conſiſtence is a thick tranſparent tremulous maſs, which attracts moiſture from the atmoſphere, and paſſes by ſtagnation and heat into the acetous and putrid fermentation. On farther examination, its conſtituent principles appear to be

1. Water in a large proportion, ſo that from 30 oz. of jelly, 18 of water are obtained.

2. Sugar, for dried jelly, heated with nitrous acid, gives out the ſaccharine and malic acid.

3. Gelatincus gluten, for it diſengages azote by mixture with the acid of nitre; and, by dry diſtillation, it yields the products of animal gluten.

4. Sea ſalt and phoſphorated calx; theſe principles being left in its carbone.

DLXIV.

This matter, thus examined, conſtitutes the nutritious juice of the animal body, and is ſupplied for the growth and repair of the ſoft parts to which it is every where carried by minute arteries along with the blood, and depoſited in the interſtices of the fibres which conſtitute the parenchyma proper to any part. Its circulation is conſtant and ſlow, as the uſe of madder to animals demonſtrates.

DLXV.

The next principle of which the muſcular ſubſtance is compoſed, is animal gluten, an elaſtic juice, inſoluble in water; and this gluten is conſpicuous after the jelly is extracted in the form of a white tenacious maſs. This maſs has neither taſte nor ſmell; and, when dried in the air, changes into a horny ſubſtance, becoming black by combuſtion, and diffuſing the fœtor of burnt hartſhorn. Expoſed to moiſture it ſoon acquires putrefaction.

DLXVI.

The elementary parts of which this gluten are compoſed.

1. A ſmall portion of water, as diſplayed by diſtillation.

2. Carbone, from the blackneſs acquired by burning.

3. Azote, which boiling with the acid of nitre, ſhews to paſs off in great quantity; and

4. A ſmall quantity of animal earth and phoſphorated calx.

DLXVII.

JOINTS.

Thus have we traced, at conſiderable length, firſt, the bones or baſis of the body; and next, on removing the common teguments and intervening ſubſtance, the muſcles or powers by which theſe bones are moved. Before proceeding farther, it is proper to complete this diviſion of the ſubject, by purſuing a detail of the particular ſtructure where the bones are joined and the muſcles fixed, with a view to facilitate the action of the latter, and to enable motion to take place in the former. This diviſion is diſtinguiſhed by the name of joints.

DLXVIII.

The conſtituent parts of the joints, we find, vary according to their particular functions; but every joint conſiſts of cellular ſubſtance and its two modifications of ligament and tendon in various, forms and proportions.

DLXIX.

The cellular ſubſtance we have already ſeen in a variety of ſituations; firſt, as a part of the teguments or univerſal covering of the body, containing the fatty cells, or being the ſeat of that fluid which makes the motions of every part eaſy and free, filling up the interſtices of the muſcles, and ſupporting their fibres at a great diſtance from each other.

2. This ſubſtance has been preſented to us in a ſtill more condenſed form when encloſing an individual muſcle in the manner of a ſheath, with a view to give form and ſhape to the part it covers, or to preſerve it in its proper ſituation; and the condenſation of this ſheath ſtill increaſes farther with action of the part and with years.

3. To accommodate ſtill more the ſhape of parts, and preſerve at the ſame time a proper power of the muſcle, a farther condenſation of this ſubſtance is made by forming it into a white cord named tendon, and this white cord forms the means of its inſertion into bone. That this tendon is of a different nature from the muſcle itſelf is clear, from its eaſy ſeparation from parts, and its want of ſenſibility, the reverſe of both which is conſpicuous in the muſcle.

4. The connection between perioſteum and tendon is alſo proved by their intermixture with each other. They are the ſame matter, only differently modified from the different ſituations in which they are placed.

5. To increaſe ſtill more the power of tendons, another modification is added to aſſiſt it, or a ſheath to prevent the muſcle ſtarting from its place; and this ſheath either forms an envelopement of the muſcle, or makes a band, tying it down in certain parts, by all which, the muſcular power is conſiderably increaſed.

6. This cellular membrane is next found in the form of bags, ſurrounding the joints, leaving the thin texture it poſſeſſes in covering the bones to be converted into a ſtrong hard bag, binding the bones together, and forming the capſule of the joint, which is farther ſtrengthened by the tendons, and occaſionally alſo by other ligaments formed out of the ſame ſubſtance.

DLXX.

Thus the cellular membrane covers the bones, forms the connecting medium of the joints, is the expanſion of the muſcles in the form of tendon and faſcia, and aſſumes different appearances to complete the ſtructure of the joints, as in that of burſæ, ligament, &c. In all theſe forms it is a part naturally poſſeſſed of little ſenſibility, ſlow in taking on increaſed action, but diſplaying a ſenſe of feeling, and acquiring a degree of inflammation when excited more permanent and violent, than in parts of a more nervous and irritable ſtructure.

DLXXI.

With theſe general obſervations, we enter upon the ſtructure of joints; and each joint we find is compoſed of the heads of the bones ſwelling out at the part where they form this diviſion of ſtructure into a broader articulating ſurface than in the reſt of their courſe, and next of a thin plate of cartilage in order to defend the ſurfaces of the two bones. Sometimes theſe cartilages are moveable, and roll upon the bones ſo as to yield to all the motions of the joint, and prevent any hurtful conſequences. The third part is glands or bags, to convey a lubricating mucus fluid. The fourth is a burſal ligament, incloſing the whole joint, and compoſing its purſe, within which is contained the ſynovia, and by which the ſurrounding parts are prevented from being catched in the joint. The fifth part is ſmall ligaments, going along the ſides of the joints on the outſide of the capſule, and paſſing from one joint to another; and the ſixth part is tendons moving over the joint, and accompanied with burſæ to prevent that injury their conſtant friction might occaſion.

DLXXII.

Such are the general parts of every joint, and we next ſhall examine the ſtructure of the different individual joints.

DLXXIII.

Joints of the Head and Back.

The joints of the head conſiſt in the manner of its connection with the two firſt vertebræ. That connection was formerly explained, ſo that its junction with the atlas enables it to perform all the nodding motions, and the junction of the atlas with the dentatus gives it the turning motions. Theſe connections the head thus poſſeſſes, are ſecured by regular capſules and ligaments. The firſt is a flat membranous ligament, extending from the ring of the atlas to the ring of the occipital hole, and thus cloſing the interſtice between the occiput and firſt vertebra. The atlas again is tied to the dentatus by ſeveral ligaments.

DLXXIV.

The firſt is the regular capſules, fixing one vertebra to another. 2. The ſecond is a croſs ligament, which, after croſſing the ring of the firſt vertebra, embraces the tooth-like proceſs, and ties it down. 3. The third is a ſmooth cartilaginous ſurface round the root of the tooth-like proceſs, to enable it to turn with eaſe. 4. The fourth is a ligament, tying the threaded extremity of the tooth-like proceſs to the occipital bone. The whole of theſe parts are included in a regular capſule like any other joint.

DLXXV.

The connections of the other parts of the ſpine are more complicated. Each vertebra is united to the one above and below. 1. By its intervertebral ſubſtance. 2. By their articulating proceſſes to each other. 3. By the croſs or intervertebral ligaments ſecuring the intervertebral ſubſtance, and which go from the edge of one vertebra to the edge of another. 4. By the general external vaginal ſheath of the ſpine, which goes over the fore part of all the vertebræ from top to bottom, being at firſt pointed and ſmall, expanding as it deſcends, ſtrongeſt in the back where there is leaſt motion, and weaker in the neck and joints. 5. By internal ligaments of various kinds paſſing between the vertebræ, and ſecuring them to each other. 6. By the internal ligament or ſheath of the medullary canal; and 7. By the internal ligament belonging to the neck alone.

DLXXVI.

Joint of the Lower Jaw.

The lower jaw, by its articulations, is a ſimple hinge, the joint of which is formed by a deep hollow in the temporal bones, by a ridge at the root of the zygomatic proceſs, and by a head or condyle; all which parts are covered with a plate of cartilage. A capſule of the common form is thrown over the joint ariſing from the neck of the condyle, and fixed into the temporal bone, by which the ſocket and root of the zygomatic proceſs are included. In the action of the jaw, the effect of theſe different parts is, that in its motions the tranſverſe ridge is required; that the uſual ſmall motions are performed by the condyle, moving in the deep ſocket or hollow; that in the more extended motions or wide openings of the mouth, the condyle mounts by the depreſſion of the jaw upon the root of the zygomatic proceſs. To facilitate the motions of this joint, there is interpoſed a moveable cartilage, thin in its centre, and thicker towards its edges, by which it rather deepens than fills up the hollow of the joint, and this cartilage correſponds in ſhape with the condyle and ſocket of the temporal bone. To ſecure the joint, it is ſtrengthened by its muſcles, the inſertion of which is cloſe round it.

DLXXVII.

Joints of the Ribs.

The ribs poſſeſs two motions, alternately riſing and falling; and the joint admitting this motion, is formed by a regular capſule covering the head of the rib hinged on the intervertebral ſubſtance, by touching each of the vertebræ between which it is placed. This capſule is regular and lubricated within, without it has a radiated form, expanding pretty broad on the ſides of the vertebræ The fore part of the tranſverſe proceſs touches the back part of the rib, and is articulated there by means of a capſular ligament. It is farther ſecured by two ligaments taking hold of the neck of the rib from the tranſverſe proceſs of the vertebra, and other ſmaller ones from different points aſſiſt for the ſame purpoſe.

DLXXVIII.

To the ſternum, the ribs are joined again by cartilages, and theſe poſſeſs the parts of a joint by having a round head, a diſtinct ſocket, a proper capſule and ligaments, which are expanded on the ſternum. Theſe cartilages are alſo bound to each other by a tendinous membrane that ſpreads over and alſo covers the intercoſtal muſcles, with a faſcia, taking its origin from different parts.

DLXXIX.

Joints of the Upper Extremity.

The junction of the clavicle and ſternum, is the hinge of the upper extremity, or is the point by which it is connected to the trunk, and on which it is moved, the round head of the clavicle being rolled upon the articulating ſurface of the upper bone of the ſternum. This articulating ſurface is compoſed of a ſmall moving cartilage which rolls betwixt the head and the ſternum, being thin and mucous. The whole is then incloſed in a ſtrong capſule formed of a bag and outer order of fibres, which radiate on the ſurface of the ſternum, or croſs and meet, ſo that by their union from the oppoſite ſides, a cord is made acroſs, named the interclavicular ligament. Thus is the clavicle and ſternum joined, while a broad ligament ties it to the firſt rib. To the ſcapula it is connected by touching the edges of the acromion proceſs, with a narrow flat articulating ſurface, tipt with cartilage, and the joint is then ſecured by a thin delicate capſular ligament ſtrengthened farther by different ligamentous bands paſſing over betwixt the clavicle and the acromion proceſs. As it paſſes over the point of the coracoid proceſs, a ligament of great ſtrength ties it down, being inſerted into the inner edge of the clavicle. Other ligaments alſo paſs from one proceſs of the ſcapula to another peculiar to that bone.

DLXXX.

Shoulder Joint.

The ſhoulder poſſeſſes a looſe moveable joint, formed by the large round head of the humerus received into the cavity of the ſcapula. This oval cavity is ſmall and ſhallow, and to lengthen it it poſſeſſes a cartilaginous border, but ſtill of a ſize inſufficient for lodging the head of the bone, which is rather laid upon it than ſunk within it. It has alſo a looſe wide capſule ariſing from the edges of the glenoid cavity, and inſerted round the neck of the bone. A large ſecretion takes place in the joint, partly of mucus, and partly of a ſerous fluid, from the termination of ſmall arteries. From this ſtructure the ſhoulder joint is looſe and free, but proportionally weak. Still, however, it is guarded by large projecting proceſſes by the acromion above, and by the coracoid proceſs within; between which, a ligament extends, ſecuring its defence above and on its inner ſide. Beſides this, it is powerſully ſecured by the inſertion of the four muſcles which ariſe from the ſcapula, cloſe round the head of the bone. By their adheſion to the capſular ligament, they render its motions free, ſtrengthen it, and preſerve it in its place; and the joint being ſurrounded with numbers of mucous bags or burſæ, which open into it, every means of obviating any hurtful conſequences from friction are guarded againſt.

DLXXXI.

Elbow Joint.

The elbow joint is more complex than the former one, and is compoſed of three bones, the humerus, radius, and ulna, which form one joint, incloſed in a capſule, ariſing from the humerus and all round the proceſſes which receive the olecranon and coronoid proceſſes of the ulna. It is inſerted into the tip of the olecranon round the cavity, receiving the lower end of the humerus, and round the edge of the coronary proceſs, being connected likewiſe to the neck of the radius. A ſupply of mucus and fat is added to lubricate the joint, and it is ſecured by ligaments on the outſide of the capſule, ſtrengthening its different points.

DLXXXII.

Thus the elbow joint is compoſed of a capſule incloſing all the bones, of ligaments in various directions to keep it firm and regulate its motions, and of cellular ſubſtance, muſcles, and tendons. Its ſtrongeſt parts are its ſides, for it is equally weak both behind and before.

DLXXXIII.

Wriſt Joint.

The wriſt is a joint of more extenſive motion than the former, and it unites the ſtrength of the hinge with the rolling motion of the ball and ſocket. From this circumſtance, it is to be conſidered in two points of view.

DLXXXIV.

Thus the articulation formed by the ſcaphoid and lunated bones, compoſes an oval ball received by the great ſcaphoid cavity of the radius, and over it a general bag or capſule is thrown. This capſule ariſes from the ends of the radius and ulna, from the ſtyloid point of the one to the ſame point of the other, and is implanted near the lower rank of the carpal bones. In this way it proves on one ſide an additional ligament to the carpus; and, on the other ſide, as the tendons of the fingers run over it, it forms a lubricating ſurface for their ſheath. Beſides this, particular ligaments alſo ariſe from the different proceſſes of the radius and ulna; and one internal ligament is noticed of a ſoft pulpy nature, which ſerves at the ſame time as a conductor for the lacunæ, which ſeparate the mucus.

DLXXXV.

The articulation of the radius with the ulna, enables the hand to perform all its turning motions. The lateral cavity of the radius receives the head of the ulna, and they are incloſed in a peculiar looſe capſule, ſo that one joint is within another, divided by a moveable cartilage.

The carpal bones diſplay ſo cloſe a connection, as hardly to form a joint; and each bone has four ſmooth ſurfaces uniting it to the adjoining bones. The great ball of the wriſt is compoſed of the firſt two bones; a ball and ſocket unites this row to the firſt, and a diſtinct and general capſule is the means of this; beſides which, each ſingle bone is tied to the next adjoining one by a regular capſular ligament within, and by flat croſs ligaments without; which, from their various convolutions, exhibit a radiated form.

The metacarpal bones are joined in the ſame manner to the carpal by joints, forming as it were one, and over which a common capſule is expanded; beſides this, each bone has its peculiar ligaments, proceeding radiated from the carpal bones, and ſpreading out upon the metacarpal, ſo that the carpus and metacarpus are ſecurely connected; and where, again, the metacarpal bones are implanted into the fingers, they are alſo bound by flat ligaments, uniting them to each other, and which allow ſuch a bending as is neceſſary to form the hollow of the hand.

DLXXXVI.

Joints of the Fingers.

The joints of the fingers form ſomething of a ball and ſocket, and are only reſtricted in their motions by their ligaments, which make them a hinge joint; for each joint is firſt incloſed in a capſule, and then ſecured by lateral ligaments on its ſides, to which its ſtrength is owing. Theſe ligaments, again, are farther ſtrengthened by the faciæ of the interoſſei muſcles, which expand over the back of the fingers. A part of the joint, alſo, at the wriſt, is the ſmooth ſheath in which the tendons of the fingers move. The outer ſide of the capſule of the wriſt compoſes it in part, and the ligament proceeding from the four corner points of the carpal bones. This ſheath is lined with a delicate mucous membrane, reſembling in its diſcharge a burſa mucoſa. This membrane, alſo, being divided into partitions between each flexor tendon, poſſeſſes a ſeparate burſa mucoſa to each; and, by this means, the hurtful conſequences of friction in theſe parts is particularly guarded againſt. The ſheaths of the tendons, in their courſe to the fingers, all form burſæ; and thus they form both the office of a ligament by binding down the parts, and alſo of burſæ from the lubricity of their internal ſurface. Theſe ſheaths vary in their thickneſs in certain points, but ſtill they form one common canal, termed the annular ligaments of the fingers, and in their offices they reſemble the offices of the burſæ, none of which exiſt in the fingers.

DLXXXVII.

JOINTS OF THE LOWER EXTREMITIES.

Thigh Joint.

The ſocket, or acetabulum of the thigh bone, is lined with a thick ſmooth cartilage, and the head of the bone is alſo covered with the ſame, and theſe cartilages fill part of its cavity, and ſmooth the junction of the different pieces of which it is compoſed. The ſocket, beſides its cavity, is deepened by the cartilage which tips its edge, and which alſo riſes upwards. At the ſide towards the thyroid hole, the bony cavity of the ſocket is imperfect, and the deficient ſpace is filled up by a ſtrong ligament going acroſs the opening from one point to the other. Of all the capſules, that of the hip joint is the thickeſt and ſtrongeſt, and it embraces extenſively every part, as well the neck as the head of the bone. Beſides this general capſule, there are alſo two internal ligaments. The firſt ariſes from the centre of the ſocket, and is fixed into the centre of the ball of the thigh bone, being ſomewhat flat and triangular. It is broad when it ariſes from the bottom of the ſocket, is about 1½ inch in length, narrow as it proceeds outwards towards the head of the bone, and round where it is inſerted into the dimpled head of the thigh bone. Round the roots of this ligament, in the bottom of the ſocket, there is left a deep hollow filled with the ſynovial gland, or rather a ragged maſs, from the ducts of which mucus is preſſed, and by this ſtructure there is leſs danger of injury from preſſure than if it had been an actual gland. A quantity of fat accompanies this ſtructure, and a ſoft mucous membrane by which the ragged maſs is tied and preſerved in its place, ſo as to move with the motions of the joint.

This ragged maſs has two or three ſmall bridles in different directions, named its mucous ligaments, and which are properly an inflection of the internal lamella of the capſule lining the ſocket, and reflected over every part of the joint. Beſides this ragged maſs deſcribed, others of the ſame nature lie at the lower part of the joint or round the neck of the thigh bone, and ſerve by their excretion to lubricate and moiſten the joint.

To ſtrengthen the capſule of this joint, although the thickeſt in the body, many additions are made to it. It receives a ligamentous ſlip from the lower ſpinous proceſs of the ilium, ſpreading out upon it, and ſtrengthening its fore part. The ſmalleſt of the glutæi muſcles ſtrengthens it behind. The pſoas magnus and iliacus internus advance along its inner ſide, and the tendon of the rectus lies upon its outer ſide. Thus it poſſeſſes many additional ſecurities, though the ſtrength of its own capſule is chiefly relied on.

DLXXXVIII.

Knee Joint.

This is a joint the weakeſt of itſelf, or in its own ſtructure as a joint, in the body, but it owes its ſtrength to the number and diſpoſition of the ligaments by which its bones are joined, which render it the ſtrongeſt and moſt ſerviceable of the whole, while the complication of ſtructure which gives it ſtrength, occaſions it in the ſame degree to be more liable than any of the others to diſeaſe.

DLXXXIX.

The bones of this joint are the tibia, thigh bone, and patella, which are thus united:

1. A thin capſule proceeds from the fore part

of the thigh bone all round the articulating ſurfaces, and paſſes by the ſides of the condyles, being inſerted into all the edge of the rotula, and keeping it without the cavity of the joint. Below, it is fixed into all the circles of the head of the tibia, and thus it embraces all the bones. From the ſurrounding parts it receives next conſiderable thickneſs. Behind, being covered by the heads of the gaſtrocnemii, by the biceps, and other muſcles of the hamſtrings at the ſides; while, by the ſeveral faſcia of the thigh, it is ſtrengthened before, and receives alſo the additional expanſion of ſeveral muſcles, which go out over the patella. In addition to this, on the back part, it poſſeſſes alſo a ligament ariſing from the outer condyle, and paſſing obliquely acroſs, which adheres to it, and ſecures the knee behind, ſerving as a check to it, in order to prevent its yielding too far: though this ligament is ſometimes wanting.

2. Strong lateral ligaments connect the pieces of this joint. The *1ſt* of theſe, broad and flat, comes down from the internal condyle of the thigh bone upon the inner ſide of the joint, and is fixed into the inner ſeat of the tibia, being named the internal lateral ligament. The *2d* ligament, round and ſtronger than the former, deſcends for the length of two or three inches from the tip of the outer condyle on the outſide

of the knee to the bump of the fibula, which it embraces; and the 3*d* ariſes, like the firſt, from the internal condyle of the thigh bone, appearing merely in a ſcattered form, as ſtrengthening the capſule, and being inſerted into the knob of the fibula.

3. The internal ligaments alſo ſecure the union of the knee bones. Theſe are termed the crucial ligaments, and are ſeated within the cavity of the joint. Their origin is betwixt the condyles of the thigh bone; and they are inſerted into the back part of the middle riſing of the tibia, lying flat upon the back of the capſule, and croſſing each other, ſo as to receive the diſtinction of anterior and poſterior crucial ligaments. Their effect is very particular. When the knee is bended, the poſterior ligament is extended; when the leg is ſtretched out, the anterior ligament is extended; ſo that they are both checks upon the motions of the joint, the anterior one preventing the leg going too far forwards, and the poſterior one preventing its being too much bent back upon the thigh.

4. The two ſemilunar cartilages are the next part in inveſtigating the ſtructure of the knee, ſo named from their form, and lying on the top of the tibia, ſo as to fill up the hollow of the bone. In their form, they are thick towards their convex, and thin towards their concave edges, ending by

two acute long horns, named their cornua, which are tied to the ridge in the middle of the articulation of the tibia; and, being turned towards each other, they touch in their points.

In this joint there are alſo fatty maſſes which incloſe the fimbriated ends of mucous ducts; and theſe maſſes are chiefly conſpicuous round the circumference of the patella. They appear alſo about the crucial ligaments, and in all the interſtices of the joints, protecting the mucous ducts, and adding to the general ſecretion.

DXC.

The inner ſurface of the capſule, on which theſe maſſes lie, is much larger than the joint it lines, and therefore it forms various folds, diſtinguiſhed by particular names. At each ſide of the patella there are two, termed the ligamentum alare majus and minus, which join in one middle fold, running acroſs the centre of the joint, and named, from its keeping the fatty bundles in their place, ligamentum mucoſum. This internal membrane covers alſo the ſemilunar ligaments, and at their horns forms four ſmall ones, two for the horns of each cartilage, named the ligaments or adheſions of the lunated cartilages. Beſides which, there is a ſmall ſlip that goes round upon the fore part of the tibia, and ties the fore part of the cartilages to each other, named the ligamentum tranſverſale commune. The cartilages alſo adhere to their outer circle or thick edge, and to the ſurface of the capſule internally.

DXCI.

In reſpect to a ſtructure for lubricating it, the knee joint poſſeſſes larger burſæ mucoſæ than any other. There is one above the patella, among the extenſor muſcles, three inches in length. There is another below the patella, and under the ligament, ſmaller. They are of the ſame ſubſtance as the capſule, and are united to it by cellular ſubſtance.

DXCII.

Thus the knee joint is rendered ſtrong by the variety of ſubſtance thrown over it to connect its parts, and by the proviſions alſo made for its eaſy motion. It poſſeſſes a capſule incloſing all its bones. It poſſeſſes additions to this capſule, in order to give it ſtrength and thickneſs from the common faſcia and particular expanſions of the muſcles. It is ſecured on its ſides by the lateral, and behind by the poſterior ligament. Internally, it is fixed by the ſame ſubſtance. To facilitate its motions, it is provided with moveable cartilages of the moſt perfect form and uſe, and to theſe are added the ſtructure for the ſecretion of mucus, and the fatty maſſes which keep it moiſtened with a conſtant ſecretion.

DXCIII.

Fibula.

The fibula does not deſerve notice as a joint. It is merely a ſupport to the tibia, but it gives adheſion to muſcles, and is the main defence of the ankle joint. It is merely laid upon the tibia, not ſunk into it, and united by a flat cartilaginous ſurface. It is tied by a cloſe capſule, and ſtrengthened by the external lateral ligament of the knee and the inſertion of the biceps tendon, both being implanted into its knob. A farther ſecurity it acquires from the great interoſſeous ligament paſſing from bone to bone.

DXCIV.

Ankle Joint.

The ankle joint acquires its ſecurity from the particular form of its bones. The lower heads of the tibia and fibula are ſo ſecured to the foot, by forming a cavity for the aſtragulus, that nothing but fracture can diſplace them; and they are alſo farther ſtrengthened by particular ligaments, one of which paſſing from the tibia to the fibula on the fore part, is named ligamentum ſuperius anticum, being compoſed of one and ſometimes two flat bands. Another broader ligament paſſes in the ſame way along the back part, and is termed ligamentum poſticum ſuperius, and a ſlip of it is named ligamentum poſticum inferius. The capſule then unites the different bones, joining the aſtragulus to the tibia and fibula. It is thin, but ſtrengthened by a variety of ligaments both behind and at its ſides. The firſt is a ſtrong triangular formed ligament, deſcends from the acute point of the inner ankle, expands radiated upon the capſule, and is fixed along the ſides of the aſtragulus. In the outer ankle there are three ligaments, one proceeding forwards, one backwards, and one directly downwards. The firſt is named ligamentum fibulæ anterius, from its proceeding from the knob of the fibula obliquely downwards and forwards, to be fixed to the ſide of the aſtragulus. The ſecond is termed ligamentum fibulæ perpendiculare, from advancing ſtraight down from the acute point of the outer ankle, to be inſerted into the heel bone. The third ariſes from the ſame point as the former, and goes backwards over that part of the capſule, being named ligamentum inter fibulam et aſtragulum poſterius.

DXCV.

To this ſtructure of the ankle joint, little farther is to be added. It is covered with cartilages, lined with a mucous membrane, and lubricated with fat and mucous fimbriæ. It is the ſtrongeſt of the joints, and requires more violence than the others to injure it.

DXCVI.

The bones of the tarſus are united to each other by their large heads, and alſo by diſtinct joints. They are alſo croſs tied to each other by ligaments paſſing in every direction, and very numerous. They are ſo complicated as to form a ſort of web on either ſide of the foot. Each bone has its capſular ligament for joining it to the next. Each joint alſo of each bone has its articulating cartilages. Over the more important bones, ſeparate ligaments are alſo thrown, ſo as to produce the greateſt ſecurity and ſtrength in the motions of this part.

DXCVII.

The metatarſal bones alſo have their capſular ligaments, which unite them to the tarſal bones. Additional ligaments ſtrengthen theſe capſules, and tie them more ſtrongly to the tarſus, and croſs ligaments tie the ſeveral ranks to each other both in the upper and under part of the foot, paſſing from the root of one bone to the root of another. The ſame ſtructure prevails here as prevails in the fingers.

DXCVIII.

To ſupport and ſecure the whole arch of the foot, as well as theſe ſeparate parts, one great ligament remains to be noticed. It extends in one triangular flat plate from the point of the heel to the roots of each toe, being named the aponeuroſis plantaris. It paſſes from point to point like a bow ſtring. It ariſes from the heel on one point, expands in the ſame proportion as the ſole of the foot, turns broad, and is divided into three narrow heads, to be inſerted into the roots of ſo many toes.

DXCIX.

In the ankle and foot, the burſæ mucoſæ are extremely narrow, but have no direct communication with the joint. They accompany the long tendons as they paſs behind the ankle or in the ſole of the foot. They run alſo along the flat face of the toes.

DC.

Such is the different forms or variety of the human joints, which it has been common to arrange into different claſſes. Purſuing this method, we obſerve,

1. In tracing the bones, many examples occur, particularly in the head, where the number of pieces is conſiderably greater than the number of motions intended; or, where the bones are connected by a number of teeth, which gives an appearance compared to a ſuture, and this obtains not only in the cranium but in the face.

In the jaws we perceive a connection of the teeth made in a very different manner; they are ſunk into the jaws, and adhere to them as a nail adheres to a board; ſo, to uſe a general term, we would ſay the bones are applied to each other, for we may overlook the membranes which are almoſt obliterated, or very thin, and ſtill the parts from their ſhape cohere, we might therefore call this ſynoſteoſis, to keep up a general analogy.

2. With regard to the number of different articulations in the trunk chiefly, we have ſeen that wherever a motion is intended; but where the danger of ſeparation is conſiderable, or where even extent of motion is dangerous, there is interpoſed a cartilage, or this with a mixture of ligament, and this has been named ſynchondroſis: but with regard to that kind of articulation, the cartilage is ſeldom found pure, even the joining of the ribs to the ſternum has a kind of articulation, as elſewhere.

A third kind of articulation is the ſyndeſmoſis, from the connection being by ligaments, while the bones themſelves have no immediate adheſion, but are tipped with cartilage, and tied together with ligaments. This obtains particularly in the extremities of the body, and it is of three kinds.

A. Where there is a free motion in all directions; and this is made by a ball and ſocket, which is moſt remarkable at the joining of the two extremities to the trunk of the body: but we find ſeveral inſtances of the ſame in the leſſer joints.

B. Next, in a number of places, we have

found a motion in a certain degree in all directions, but very limited; or, where the ſurface of the bones were almoſt flat, and the ligaments very ſhort, particularly in the joining of the tarſal and carpal bones with thoſe of the hand. The third kind is the

C. Hinge, which is of three ſpecies.

a. The connection of the head to the ſpine, turning upon a centre pin; and we have no inſtance of the ſame kind in the other parts. But the moſt common ſpecies is

b. Where one or more bones are included in one capſular ligament, as the joining of the humerus with the fore arm, and where the ſhape of the bones and length of the ligament regulate the motion to two directions, the ligaments at the ſide preventing the lateral motion, and even the bare bones not readily performing a lateral motion. And we ſhould reckon a third kind

c. Where two move upon each other in different places, and with two joints, yet we conſider them as one. Thus the back part of all our vertebræ have a pair of oblique proceſſes, which are intended for one motion. In like manner the ribs are not only connected to the vertebræ by a round ball, but likewiſe to the tranſverſe proceſſes, and thus too the radius is connected to the ulna which conſpire to accompliſh one general motion, as in like manner do the tibia and fibula.

Now every one of the joints of the body can be reduced under one or other of theſe articulations. For the syſſarcoſis is only to be found in quadrupeds, and the ſcapula and clavicle are connected in the uſual way to the bones of the body.

DCI.

BURSÆ MUCOSÆ.

In examining the joints, we have taken notice of a particular ſtructure, the burſæ mucoſæ. The membrane of theſe cavities within is very ſmooth, and a quantity of fat is found conſtantly on the outer ſide. In ſeveral of the burſæ, the fat is even ſeen projecting into them, and upon the inner ſide there is found a ſlippery liquor which is often collected in conſiderable quantity, as in the burſa behind the tendo achillis. This liquor does not coagulate in a burning heat, and very much reſembles the ſaliva; but, it has a quantity of oil very intimately mixt with it, and the liquor of the burſæ may be compared to the liquor found within the articulations. There is an analogy between the capſular ligaments and theſe burſæ, and there frequently appears a communication between the large burſæ at the knee, and the cavity of that joint. It is of particular uſe in practice to be acquainted with all the ſheaths of the tendons of both extremities, for within every ſheath there is a fine burſa running a very conſiderable way; and, where a number of tendons enter at one common place, as at the wriſt, we find the tendons dividing, and a burſa produced under each, which is frequently the ſeat of diſeaſe by becoming enlarged in ſize, and filled with a viſcid glairy matter.

DXCII.

The chief ſeat then of the burſæ is the extremities and between tendons and bones, where they play upon each other, as at the inſertion of the biceps flexor cubiti.

Or, where tendons rub on each other, as between thoſe of the extenſores carpi radiales and extenſores pollicis.

Or, between tendons and the external parts, as in the ſheaths of the tendons of the flexors of the fingers and toes, where they furniſh a lining to the ſheaths, without communicating with other parts.

Or, between tendons and ligaments of the joints as between the tendons of the flexors of the fingers, and capſular ligament of the wriſt.

They are found in a few places, where proceſſes play upon ligaments as between the acromion and capſular ligament of the humerus.

Or, where bones play on each other, as between the clavicle and coracoid proceſs of the ſcapula.

Some of the burſæ of contiguous tendons communicate with each other, as between the extenſor carpi radialis, and extenſor ſecundi internodii pollicis.

Others communicate, not only in adults, but often alſo in children, with the cavity of the joints, as behind the tendon of the extenſors of the leg, though this is more frequently the caſe in advanced age.

DXCIII.

The general ſtructure of theſe burſæ is the ſame with the inner capſule of the joint. They are formed, as we obſerved, of a thin pellucid membrane, poſſeſſed of little feeling, and joined to the ſurrounding parts by cellular ſubſtance, and in many by a covering of fat. They commonly poſſeſs alſo a thin layer of cartilage, or of tough membrane between them and the bone. Maſſes of fat project alſo into their cavities, having a fimbriated edge, and they are lubricated by the ſame gelatinous ſecretion as takes place in the joints. Thus, to leſſen friction, is the ſole intention of their ſtructure, and only where the parts are expoſed to this, in conſequence of their action, are the burſæ to be looked for.

DXCIV.

From this general deſcription of theſe burſæ, and their uſe, their ſituation in the different parts of the body muſt be apparent without entering into any ſpecial detail, which ſome authors have reckoned neceſſary. In all tumors of the joints, their ſituation with reſpect to the burſæ mucoſæ requires particular attention, in order that we may be able to aſcertain exactly their nature, and form a prognoſis from this circumſtance of their degree of danger.

DXCV.

Chemical Analyſis of the Joints.

1. Membrane, which is the baſis of the cellular ſubſtance of ligament, tendon, and cartilage, is little elſe than gelatin. If any of theſe ſubſtances be boiled in water, it is nearly entirely diſſolved; and, when cool, the ſolution is gelatinous. Cellular fibre, therefore, is conſidered as gelatin, rendered concrete by a degree of oxydation; and ligaments, tendons, and cartilages, differ only in containing a greater proportion of phoſphate of lime.

2. As well as the ſolids, the fluids of the joints, or ſynovia, deſerves to be analyſed. The ſituation of this fluid was already noticed in the demonſtration of theſe parts. This ſecretion poſſeſſes a fatuous animal ſmell, and a ſaltiſh taſte. It is of a viſcous conſiſtence, and of a greeniſh white colour. It exiſts in various quantities in the different joints, but is moſt abundant in the joints of the femur and knee.

3. The conſtituent principles of the ſynovia are water, lymph, an albuminous principle, muriate of ſoda, carbonate of ſoda, and phoſphate of lime, but this laſt in very ſmall proportion.

4. The fluid of the burſæ mucoſæ or tendinous ſheaths, appears of an oily mucous nature, and it is collected in caſes of diſeaſe or ganglon in great quantity, in the form of allumen.

DXCVI.

Vascular System.

Heart.

In examining the muſcles, their red appearance we find the conſequence of a coloured fluid pervading their fibres, and confined within certain tubes or veſſels diſtributed through every part of them. The origin of theſe veſſels, when traced farther, appears to be in a large organ, the heart; and this organ is placed in the middle of the body, and is the centre of the vaſcular ſyſtem. The veſſels on which this organ more immediately acts, are the arteries and veins. By the former, the blood is diſtributed over the body with force and pulſation; by the latter, it is returned in a ſlow and languid ſtream back to the organ from which it was diſcharged. The ſituation of the organ is between theſe two ſets of veſſels receiving the blood by the veins into its cavity, and expelling it again from it with ſtrong contraction by the arteries. Nor is this all, for, beſides the ſimple expulſion of the blood by its peculiar form of organization, it diſtributes it through the lungs, ſo that the fluid may be purified or oxydated in that organ, and conveyed to the body in a fit ſtate for performing its functions.

DXCVII.

From theſe different offices, the heart poſſeſſes a two fold ſtructure, as formerly noticed in a general way, (XV.) or a heart fitted for the circulation of the lungs, and a heart fitted for the circulation of the body; and the propriety of this diſtribution is evinced by the difference of ſtructure in this organ, between animals that breathe, and animals that do not. In the animals that do not breathe, the heart is ſingle, or conſiſts of an auricle and ventricle, with an artery and vein. In the animals that breathe, this ſtructure is double. The right ſide is appropriated to regulate the circulation of the lungs; the left ſide, to perform the diſtribution through the body.

DXCVIII.

With this general idea in view, we deſcend to the particular ſtructure of the organ.

1. The firſt part of it to be demonſtrated is the two venæ cavæ, ſo named from their ſize, the one bringing the blood from the upper, and the other from the lower parts of the body, the former named the cava deſcendens, and the latter the cava aſcendens. Previous to their forming one trunk, they receive the collected large veins of different parts of the body, the deſcendens being joined by the right jugular and right axillary vein, and by the great branch containing both the veins of the left ſide, the aſcendens being in like

manner joined by the cava abdominalis and hepatica; and both the cavas unite together in the end, to form the right ſinus of the heart.

2. This ſinus is merely the dilatation of the two veins, forming a reſervoir for the conſtant ſupply of the organ. As the veins approach this part, their ſtrength is increaſed; and as the ſinus approaches the auricle, it becomes ſtronger alſo in the ſame proportion. In ſtrength, the auricle and ventricle are pretty uniform, and their ſtrength is increaſed by the various croſſings of muſcular fibres, and by deep riſings and furrows upon the inner part.

3. The angle of the two veins has been termed the tuberculum loweri, and which being cuſhioned up alſo on the outſide by fat, has been noticed as a remarkable part by moſt anatomiſts.

4. The auricle, ſo termed from its reſemblance to a dog's ear, is an appendage to the ſinus, being ſmall, ſemicircular, and notched; and it is the extremity of the ſinus on the one hand, while the veins are on the other. In the auricle, the muſcular fibres diſplay ſtrong deep furrows that croſs each other, and are named the muſculi pectinati, reſembling in their appearance the teeth of a comb, while the texture of the auricle itſelf is beautiful and tranſparent.

5. The valves of the auricle are placed between it and the ventricle, and they ſerve to regulate the

movements of the heart. Thus, as the cavas pour in the blood upon the ſinus and auricle, and the auricle puſhes it on to the ventricle, the valves prevent its return from the latter till it is enabled to act and expel it. That they are fitted to do this is evident, for the tendinous circle or hole between the auricle and ventricle is covered with a thin membrane hanging down into the ventricle, which grows gradually thinner and divides into fringes. Theſe fringes are tied to the inſide of the ventricle like tendinous cords, which they are named, and are attached to proceſſes projecting from the muſcular part of the heart. Of theſe attachments, there are three points dividing the circle into three acute pointed valves, named valvulæ tricuſpides. All theſe parts croſs each other; and, by this croſſing of their tendons the valves fall down when the blood paſſes through them, and they riſe when it gets behind them.

6. The ventricle of the right ſide, like the auricle, is larger than that of the left, being, as formerly explained; the heart of the body, and it is therefore more ſubject to occaſional turgeſcence than the other. This ventricle is thick and fleſhy, and very irregular on its inner ſurface, in every part of which it puts out ſtrong fleſhy columns. The ſize and courſe of theſe columns alſo vary, ſome running length and others croſs ways, ſo that its oppoſite ſides are connected together, and

they form a ſet of ſtrong fleſhy muſcles. In the interſtices of theſe columns are deep and irregular grooves, where the blood coagulating, forms polypi after death. Beſides its difference of ſtrength, and alſo larger cavity, the right ventricle differs from the left in the peculiar partition or ſeptum cordis belonging to the left one.

By the ſituation of the right ventricle, it is wrapt as it were round the left one, and the latter forms the acute apex of the heart, and bulges very much into the cavity of the right one. In the internal ſtructure of both ventricles, the ſurface appears rugged and irregular towards the opening of the auricles, and ſmooth and pervious as it leads to the artery.

7. The pulmonary artery carries out the blood from the right ventricle near to the opening where the auricle receives it; and the artery aſſumes here a triangular, irregular ſhape, ariſing from its valve. This valve conſiſts of three knobs, behind which, is a dilatation or little bag, termed a ſinus. The ſtructure, indeed, of all the valves in the mouths of the great arteries is ſimilar. They are three in number, originating from the circle of the artery as it riſes from the heart. In their ſhape they are ſemilunar, with their looſe edge hanging into the artery; and, when they unite together, they complete a circle, and cloſe the mouth of the artery, ſo that nothing can paſs. By the action

of the ventricle, the blood is puſhed into the artery; and, by the contractile power of the latter it is carried forward to the lungs, from which it is returned to,

8. The left auricle of the heart, which differs ſomething from the right, in its ſmaller ſinus and larger auricle. This ſinus is formed by the pulmonic veins, which come in four great trunks from the lungs, two from the right ſide, and two from the left. At each ſide of the left auricle, two great veins then enter, which give it a ſquare form, and the whole left ſinus is turned backwards towards the ſpine, is more of a cubic form than the right one, but reſembles it in the uniformity and ſmoothneſs of its outer and inner ſurfaces.

9. The valve of the left auricle, from its ſmaller ſize, and particular form, is termed the mitral valve, reſembling in appearance the form of a mitre. In every other reſpect, the ſtructure of the two auricles agrees. The left ventricle, again, is longer than the right one, is ſmaller in its cavity, and ſtronger in its fleſhy columns.

10. The ſemilunar valves of the aorta reſemble thoſe of the pulmonary artery, and only exceed in ſuperior ſtrength; and, being furniſhed with ſmall hard tubercles placed on the apex of each valve, they meet when it is cloſed, and give more reſiſtance, ſo as to prevent the valve being forced.

11. The aorta ariſes by a large ſtrong opening from its ventricle, and exceeds in ſize the pul-

monary artery, ſwelling out ſo as to form three diviſions; the curvature at the arch of the aorta being called its great ſinus, and the other three, the leſſer ſinuſes of the aorta.

DXCIX.

Such is the general view of the ſtructure of that organ, ſo neceſſary to the ſupport of life; and the next point that remains is, by what means is its own circulation ſupplied, ſo as to enable it to give circulation to the body. This takes place by means of the two firſt branches the aorta gives off, which poſſeſs a peculiar and beautiful ſtructure. They ariſe immediately under the valves of the aorta, are termed coronary arteries, and are two in number, while their veins terminate by one trunk in the right auricle. In their progreſs, one of the coronary arteries runs in a groove between the right auricle and ventricle, and gives circulation to the right ſide of the heart. The other is diſtributed partly between the left auricle and ventricle, and partly in the groove between the ventricles on the forepart of the heart, ſupplying the left ſide of the heart, and forming communications with the other artery. From their peculiar origin, it has been doubted whether their ſupply of blood correſponded to the general laws of the circulation, and was received from the aorta, or immediately from the heart; but the former of theſe ſeems chiefly eſtabliſhed.

The coronary veins return the blood from the correſponding arteries, and they join chiefly into a great trunk, named the great coronary vein; which, after making a turn from the left ſide of the heart, and running between the left auricle and ventricle, terminates in the under part of the right auricle, covered by its ſemilunar valve.

DC.

To finiſh the deſcription of the heart, there remains the euſtachian valve, ſituated at the mouth of the aſcending cava, where it joins the ſinus. In its form it reſembles a creſcent, with its convex edge fixed to the union of the ſinus and cava; and the concave edge turned obliquely upwards, reaching about half way over the mouth of the cava. In its ſize and appearance, it varies much in different ſubjects. This valve is equally diſtinct in the adult as in the fœtus; but in the former it is frequently found reticulated, an appearance ſeldom met with in the latter.

It is conſidered in the adult as preventing the blood of the auricle from paſſing into the inferior cava; and in the fœtus, as directing the blood of the ſuperior cava to the foramen ovale which lies behind it, and the remains of which always continue conſpicuous.

DCI.

The heart then is a hollow muſcle, ſituated in the cavity of the thorax, of a conical figure, with its baſe placed backwards next the ſpine, while its body and apex are turned forwards and obliquely over to the left ſide. In quadrupeds, it is placed in a line with the ſternum, and the point only touches the diaphragm; but in man, the point is a little lower than the baſe, and projects between the two lobes of the left lung, a little below the left nipple, where the pulſation may be felt. Its ſituation, however, always varies a little from the poſition of the body, and the ſtate of reſpiration. Nor have inſtances been wanting where the heart has occupied the right ſide of the thorax, though they are rare; and its ſituation has been even known to be altered by diſeaſe.

DCII.

The heart is covered by a particular membrane or ſac, named the pericardium. It is one of the ſtrongeſt in the body, adapted to the organ it contains. It conſiſts of two layers, the external of which is a continuation of the mediaſtinum that paſſes to the lungs and lateral parts of the diaphragm. The internal is ſmooth, tendinous, and poliſhed on its inner ſurface, and alſo of greater ſtrength than the former.

DCIII.

This membrane adheres to the tendinous part of the diaphragm, and contains a liquor which ſerves to lubricate the heart and facilitate its motions, undergoing the ſame ſecretion and abſorption as in other parts of the body. In its extent, this covering paſſes alſo a conſiderable way beyond the baſe of the heart, including the large blood veſſels at their roots or origin; and thus it forms angles, or cornua, correſponding to their curvature.

DCIV.

The internal membrane of the heart, which is glued to its muſcular fibres, when it reaches the entrance to its cavity, is reflected, becomes thicker, and by its continuation forms the internal layer of the pericardium, already noticed. The cellular ſubſtance connected with the outſide of the pericardium, is connected with the veſſels, runs along them for ſome way, and gives to them additional ſtrength and firmneſs. The uſes of the external membrane and pericardium are apparent from their ſituation and connections. The pericardium evidently ſerves to ſuſtain the heart in its place, to prevent it from ſhifting too much, from bearing by its weight upon the veſſels that enter it, and from diſturbing the functions of the lungs; and hence, both pleura and mediaſtinum are continued down over the pericardium, as we ſhall afterwards perceive.

DCV.

When the pericardium is cut into, the inner ſurface of it, as well as the outer ſurface of the heart, is ſlippery, ariſing from the liquor, we already obſerved, that the pericardium contains; and this liquor exudes from the extremities of veſſels ſo very minute, that they eſcape obſervation. Beſides this, there is conſtantly found collected a quantity of fat between the outer membrane of the heart and the fleſh, and that in perſons who are otherwiſe greatly emaciated; and this fat muſt exude to mix with the ſecreted liquors, juſt as we ſhall find it do from the omentum within the abdomen; ſo, while the connection of the heart to the neighbouring parts is prevented, it ſlides and plays without injury to itſelf, or to the neighbouring organs.

DCVI.

On proceeding into the heart itſelf, and comparing its ſubſtance with the other muſcles, its fibres are more cloſely connected than the common muſcular fibres are, whereby they ſerve better to contain the blood; and, perhaps, farther they are endowed with greater powers of motion, and are more exquiſitely ſenſible than thoſe of the other muſcles. The fleſhy fibres in general proceed from, or terminate above, the mouths of the ventricles; and hence every part of the heart contracts towards this place. The auricles deſcend towards it, and the ventricles are drawn upwards towards it, while the heart is admirably adapted, ſtraitening itſelf in all its dimenſions. It is an error to ſuppoſe that the heart, when in action, is only made narrower. This ſuppoſition has ariſen from obſerving, that when the ventricle is in action, the heart ſtrikes the ſide: but this depends chiefly upon the particular kind of motion of the ventricle, while, at the ſame time, it is brought nearer to the ſide by the arteries and auricles filling at once; for the blood begins to be ſtopped and accumulated while the ventricle is in action, in conſequence of which the heart turns as it were upon its axis, which is placed about the baſis of the heart.

DCVII.

In reviewing the cavities of the heart, we are naturally led to the cauſes which determine the blood in a certain courſe through them, beginning with the venæ cavæ.

Theſe we have ſeen meet to form the right ſinus, which is evidently muſcular, as is likewiſe the termination of the vena cava, which has the ſame ſtructure as the ſinus, contracting like it, and that in a very remarkable degree. What we call auricles, form a common cavity with the ſinus; and, as a proof of this, it is only neceſſary to compare the two ſides, for, on the right ſide, the auricle is larger, and the ſinus leſs; on the left, again, theſe proportions are reverſed. At the entrance of the inferior or aſcending cava, we find a turgeſcence of the edge of the auricle, or valve, named after Euſtachius, to prevent the blood from falling down into the cava in our erect poſture. Where the auricle is joined to the ventricle, we perceive the valvulæ tricuſpides, ſo named from its being broader in three places, and which ſerves to direct the courſe of the blood into the ventricle. The connection of the valve to the ſide of the ventricle is made by fleſhy pillars, the uſe of which is not, as ſome anatomiſts have ſuppoſed, to open the valve, but to prevent the valve, when the heart is in action, from being turned back into the auricle. We are not to ſuppoſe that theſe pillars are in action at one time, and all the reſt of the heart at another, but rather they are in action at the ſame time with the ſides of the ventricle. The inner ſide of the ventricle is every where unequal, with a number of fleſhy pillars, and an attention to theſe might be ſufficient to convince us, that every drop of the blood is not ſqueezed out at every contraction of the heart, but it is very nearly ſo, inſomuch, that in ſmall animals it changes its colour. We can never imagine that every hollow or depreſſion has its correſponding riſing to enter it, ſo that ſome ſmall part of the blood ſtill remains.

DCVIII.

From the right ventricle is the only paſſage left into the pulmonary artery; and at the mouth of the artery are three valves, named ſygmoidal. They are entirely membranous, formed of the inner membrane of the heart and arteries lengthened out. The pulmonary artery is divided into two great branches, one to each lobe of the lungs; and the blood is returned by four great veins, which terminate in the left ſinus. With this ſinus a ſmall auricle is connected, the cavity of the whole being nearly equal to that of the right ſide, but hardly ſo large; then there is a ſimilar paſſage into the ventricle, and a paſſage from thence into the aorta. The chief difference here is in the thickneſs and ſtrength, for a greater force is neceſſary to drive the blood through the numerous branches of the aorta, than to drive it through the lungs; and, if we are to judge of the force by the thickneſs, it is nearly three to one. The valves, &c. are nearly the ſame as in the right auricle, and the valves at the beginning of the aorta are named ſemilunares. The blood is then carried by the aorta to all the different parts of the body, and is returned again to the heart by the vena cava, as is evident from examining the heart. A valvular ſtructure, it may be obſerved, is wanting in two places where it might be expected, being at the termination of the veins into the auricle. Thus there are no valves at the termination of the cava and pulmonary veins to prevent the blood from being thrown back. The reaſon of this would appear, that there might be a danger from preventing a degree of regurgitation in certain caſes from the forcing of blood conſtantly forwards into the heart; but, even in the ordinary courſe of the blood a valve is not neceſſary, the current in the veins being ſufficient to direct the courſe of the blood; and it can only appear difficult to account for the want of valves to thoſe who look upon the heart as acting like a ſpring, ſo that as much force is uſed to fill the ventricle as it employs in emptying itſelf. But the ventricle is altogether relaxed ſo ſoon as it is emptied, ſo that a very gentle effort of the auricle is ſufficient to fill it. Whereas, in conſequence of the ſuddenneſs and violence with which the ventricle contracts, the blood would have been thrown every where, were there not a valve between the auricle and ventricle.

DCIX.

Chemical Analyſis of the Heart.

The ſtructure of the heart differs from the other ſoft muſcular parts in its greater proportion of fibrine. The ſecretion of its covering, or the pericardium, conſiſts of a gelatino albuminous water.

Anatomical Preparation of the Heart.

From the importance of the heart, as the principal organ of the body, it has been commonly ſelected, that its ſtructure may be well underſtood, as a fit ſubject for preparation, and the organ has been either dried, or injected, and corroded for this purpoſe.

Dry Preparation.

1. To make a dry preparation, a heart ſhould be

choſen free from fat, nor is it neceſſary to preſerve any length of veſſels. The cavities and internal ſurfaces ſhould be well waſhed out, and the organ macerated in water for ſeveral days, or as long as may be without weakening the parts by putrefaction; that when finiſhed, it may be as tranſparent as poſſible. When ſufficiently macerated, the extremities of the veſſels are to be tied up, but a pipe is firſt to be fixed in the ſuperior cava, entering the right auricle to fill the right ſide of the heart, and another is to be tied to one of the pulmonary veins, entering the left auricle in order to fill the left ſide. The organ is then to be injected with melted tallow, and afterwards ſuſpended in the air till perfectly dry; and this ſhould be continued ſome weeks, even after the outſide appears dry. When the drying is finiſhed, the extremities of the veſſels are then to be cut off, and ſuch openings made into the auricles and ventricles as will afford the beſt inſpection of the internal parts. It ſhould then be placed at a proper diſtance from the fire, and in ſuch poſitions as will be beſt adapted for melting and draining out the tallow from the cavities and veſſels, which ſhould be ſtrictly done, and in doing it, avoid exceſs of heat. When finiſhed, the preparation ſhould be coated with white ſpirit varniſh.

Corroded Preparation.

2. For the purpoſes of corroſion, a heart, whether fat or lean, may be equally choſen. When taken out of the body, it is to be waſhed very clean, taking care that there be no coagulum left, in which particular precaution is required. The water being thoroughly

drained, a pipe is to be fixed in the ſuperior cava to inject the right ſide, and another in one of the pulmonary veins to inject the left ſide. The mouths of all the other veſſels are then to be ſecured by a ligature, and the two ſides of the heart injected with different coloured injections. When cold, the pipes are to be removed, and the part put into the corroding liquor, which ſhould conſiſt of three parts of muriatic acid to one of water, and remain there for three or four weeks, or ſuch longer time, till the ſoft parts are deſtroyed. The preparation is then to be waſhed, and an exact model of the internal parts of the heart, and the large blood veſſels will be thus procured. To preſerve it, it ſhould be varniſhed, and placed under a cover to preſerve it from injury.

DCX.

Before proceeding to any detail of the vaſcular ſyſtem, it will be proper, after the heart, to take a general view of the principal organs concerned in the circulation. On this plan we are firſt led to the examination of the lungs.

DCXI.

Lungs.

The lungs, we find, are two ſoft ſpongy bodies, filling the greater part of the cavity of the breaſt, bounded by the two bags of the pleura, and every where in contact with the adjacent parts, ſo as to admit no intervening air, or other fluid, between them and the thorax.

DCXII.

In their ſhape they exactly correſpond to the inſide of the thorax or cavity they fill. Thus they are rounded towards the ribs, hollow towards the diaphragm, and irregularly flattened and depreſſed towards the heart.

DCXIII.

The colour of this organ varies ſomewhat at different periods of life. In children, the lungs exhibit a reddiſh or pink colour. In adults, they poſſeſs a light blue or greyiſh appearance; and, in old age, they become more of a purple and livid hue, with the occaſional traces of black ſpots in different parts of their ſubſtance.

DCXIV.

The connections of the lungs to the adjacent parts are not numerous. Above, they are joined to the neck by the trachea (CCXCIX); by the two layers of the mediaſtinum to the ſpine, and to the heart by the pulmonary veſſels. In other parts they are entirely free, and become only connected in conſequence of diſeaſe.

DXCV.

From their ſituation and diviſion, the lungs are ſeparated into two parts; and this ſeparation is made between them by the heart, and the farther intervention of the mediaſtinum. They are diſtinguiſhed therefore into their right and left portions.

DCXVI.

Each of theſe portions is farther ſubdivided into what are termed lobes; and by this diviſion their motions are facilitated, and the dilatations of the different parts rendered more ſimple and eaſy; (three of which belong to the right portion of the lungs, and only two to the left). For theſe two laſt purpoſes, alſo, we find a ſtill farther ſubdiviſion prevail; for the lobes conſiſt of ſmaller parts of different ſizes, and of an irregular angular ſhape; and theſe ſmaller parts receive again the appellation of lobules.

DCXVII.

The lobules, as they diminiſh in ſize, degenerate at laſt into ſmall veſicles, or cells; and theſe veſicles conſtitute a large part of the ſubſtance of the lungs, and on which their peculiar function depends.

DCXVIII.

The ſtructure of the cells is membranous. In their figure they are irregular. They are compreſſed and cloſely connected; and they poſſeſs a free communication and intercourſe with each other.

DCXIX.

The whole of theſe parts deſcribed are connected by cellular membrane, which is interpoſed between them, unites and ſtrengthens them, and is the medium through which their circulation is diſtributed. It poſſeſſes, however, no immediate communication with the cells, which are only affected through the trachea, and in no other way; and it is alſo totally deſtitute of fat in this ſituation.

The coverings of the lungs conſiſt of two coats, the external and internal; the firſt is a continuation of the pleura, or general covering of the thorax, which is merely extended over their outer ſurface. The latter, though adhering to the former, both covers their ſurface, and alſo inſinuates itſelf into every part of their ſubſtance.

DCXX.

From this view, then, the lungs are contiguous to the pleura, every part of the thorax preſſing againſt another; and thoſe who have entertained a contrary opinion, have been miſled, by drawing too close an analogy between animals of very different kinds, as from birds, where the trachea arteria perforates the lungs, and communicates with cavities beyond them. But the lungs are adapted to follow the motions of the thorax, and every circumſtance ſhews the continuity of parts; even when the lungs are in a collapſed ſtate, they exactly repreſent the containing parts, and we often find a partial, and ſometimes a total adheſion of the lungs to the pleura. Upon opening the thorax, we ſee no paſſages by which air can get into it; we find the lungs touching the pleura; and, if we open the pleura under water, no bubbles of air riſe through the water. So that the lungs fill the cheſt, and we can very well underſtand the reaſon of this. We need only attend to the effect of the air on a weather-glaſs, where the weight of it is ſufficient to ſuſtain the weight of about 30 perpendicular inches of quickſilver, and it is able to keep up water to the height of 30 feet and more; it is ſurely ſufficient therefore to expand the lungs, and keep them contiguous to the pleura. If this then is underſtood, it only remains, in order to explain reſpiration, that we underſtood the ſtructure of the thorax, and the manner in which its parts may be enlarged and contracted, and we may view the lungs merely as bladders, and conſider them as paſſive, as they certainly are with reſpect to their dilatation; and it is ridiculous for ſurgeons to talk of the lungs expanding themſelves ſo as to throw out matter that is collected within them. With regard to their contraction, they have a certain degree of elaſticity, as ſome of the muſcular fibres of the trachea extend to their remoteſt cells; but the effect of theſe muſt be inconſiderable; ſo that, while the dilatation depends upon the containing parts, the contraction depends almoſt upon the very ſame thing.

DCXXI.

In explaining then reſpiration, we obſerve that any ſolid body may be enlarged in three ways, in length, breadth, and depth, ſo we dilate the thorax in all theſe ways. The diaphragm is excellently fitted for lengthening out the cavities of the thorax, for we have ſeen it preſſed up into the thorax like the crown of one's hat; and, when in action, its fibres become ſtraight, and the cavities of the thorax are elongated, and the abdominal muſcles are put upon the ſtretch, or are puſhed outwards. Next, we may obſerve that our ribs are fitted for making the thorax broader, for increaſing the diſtance between the two ſides, and, at the ſame time, for rendering it deeper, or for increaſing its diſtance between the ſternum and ſpine. Thus, if you bring the ribs to be more perpendicular, the ſternum is puſhed away from the ſpine, for the upper ribs being more fixed, whilſt the under ones are moved upwards towards them, they are turned outwards; and, as the ends of the ribs have thrown in betwixt them a cartilage, which is crooked, this is thruſt out, ſo that the diſtance between the ſides is increaſed. The power by which this motion is performed, is beyond all doubt, the contraction of both the rows of the intercoſtal muſcles; at the ſame inſtant, when theſe contract, the moſt moveable part moves towards the one that is the more fixed. The only difficulty here, and which has puzzled many anatomiſts, is to account for the obliquity of the intercoſtal muſcles.

DCXXII.

This has been already explained, and from this obliquity we have proved that great powers of action are acquired by them, and theſe powers are alſo increaſed by their being wanting near to the ſternum and ſpine. (CCCCLXVIII, &c.)

DCXXIII.

Suppoſing, then, we have made a full inſpiration, and after a little we feel an uneaſineſs, and mean to expire, the parts are replaced in this manner. The diaphragm is replaced by its elaſticity in ſome meaſure, becauſe in its action it pulls down the elaſtic membranes within the thorax, ſtretching the mediaſtinum to a certain degree. The elaſtic air contained within the ſtomach and inteſtines, and which does not readily eſcape, will alſo have ſome effect; but the diaphragm is chiefly replaced by the contraction of the abdominal muſcles. For, as ſoon as we ceaſe from acting with it, the abdominal muſcles are ſolicited to act, to preſs the bowels of the abdomen upwards againſt the diaphragm, ſo as to bring it to its natural place, which is more eſpecially neceſſary in the erect poſture; when we are laid horizontally, the elaſticity of the parts and weight of the bowels in a manner do the buſineſs. For replacing the ribs, the cartilages are ſufficient for the purpoſe even in the dead body, inſomuch, that we always find the body in the ſtate of expiration. But farther as the abdominal muſcles in expiration are brought into action in order to replace the diaphragm, the external oblique being fixed to the ribs, muſt alſo have the effect of drawing them downwards. When the muſcles of the abdomen puſh the bowels of the abdomen inwards and upwards, they muſt alſo have the effect of drawing the ribs directly downwards; and, when we want to perform the expiration with greater force, we exert theſe muſcles in a ſtill greater degree. But, if we want to perform it with violence, every muſcle, though deſtined principally for the motion of the trunk or extremities, may be brought to influence the ribs.

DCXXIV.

Now, after we underſtand the manner of reſpiration in life, we readily know the uſe of the diviſion of the thorax by a partition, the mediaſtinum; for we perceive that a wound made in the thorax through the pleura muſt be attended with a great degree of danger, as in conſequence of the admiſſion of the air, a collapſe of the lungs from the natural elaſticity muſt take place, and we could not have it in our power to dilate and contract them alternately. Whereas, in conſequence of this diviſion, we can make a ſhift to live, though perhaps a very conſiderable opening be made in one ſide, for the lungs will not collapſe when one ſide is wounded, as they do in a dead body upon the opening of the thorax, for then the other ſide is at reſt, and their natural tone bring them to a ſmall compaſs, but the oppreſſion from the wound occaſions a great exertion with the other ſide in order to dilate the thorax; and whilſt a great deal of air enters through the wound, ſome likewiſe goes by the trachea arteria to the wounded ſide, ſo that there is a very ſmall dilatation in that ſide. In this caſe too, the expiration is performed with the like violence, and the glottis is in a great meaſure contracted. Hence the air is thrown from the ſound ſide into the wounded, ſo that there is an inſpiration of the wounded ſide, while there is an expiration of the other, and in that way life may be continued. Beſides, this partition ſerves for conducting the veſſels for ſupporting the parts, &c.

DCXXV.

Chemical Analyſis of the Function of the Lungs.

The function of reſpiration is one of the moſt important of the animal body, and it is only from the diſcoveries of chemiſtry that its uſes have been fully underſtood. It conſiſts of two actions; inſpiration, by which we draw air into the lungs, and expiration, by which we expel it from them. The air drawn into the lungs is clearly atmoſpheric air. In an adult, each inſpiration carries in about 30 cubic inches of it, and as in the ſpace of a minute we inſpire 15 times, hence there is required every minute 450 inches of this fluid, every hour there is required 27,000 ditto, and in 24 hours 648,000 ditto.

2. This atmoſpheric air acts in two ways; *1ſt*, by its weight and elaſticity in dilating the pulmonary veſicles, and thus allowing the regular progreſs of the circulation of the lungs; and *2dly*, the purpoſe for which it is principally required, by communicating to the blood of the pulmonary veins vital air, on which the continuance of life depends.

The uſes of vital air mixed with the blood are:

a. To give the proper irritation to the heart exciting it to act.

b. To produce the arterious blood, or communicate to it its florid red colour.

c. To produce animal heat, in conſequence of the vital air being decompoſed by the animal gas or carbonated hydrogene.

d. To diſengage the carbon from the animal gas, and allow it to paſs into the venal blood.

3. Correſpondent to theſe principles, the air expired from the lungs is a different compoſition from that received, and conſiſts of

a. Water, for poliſhed glaſs, we find moiſtened by it.

b. Carbonic acid gas, or fixed air, as proved by the precipitation of lime if breathed through lime water.

c. Azotic gas, for it ſuffocates animals, and extinguiſhes the flame of a candle.

4. Thus, by reſpiration, important changes are produced. The venous blood abſorbs oxygen, and acquires in conſequence a florid red colour; and the ſame muſt happen alſo to the chyle, as none of this fluid can be diſcovered when it paſſes the lungs, and the whole is uniformly red. From the chyle, alſo, it would appear farther that hydrogen and carbon are abſtracted in conſequence of this abſorption, in order to allow it to be converted into fibrine, or that matter which is neceſſary to the formation and repair of the ſolid parts.

Nor does the uſe of oxygen terminate here, on it is dependent the temperature of the body; and the quantity of air breathed by the different claſſes of animals, determines the actual height of their temperature. Thus the temperature of man is only 96, while that of birds, who breathe more, is equal to 103 or 104.

Anatomical Preparation of the Lungs.

The ramifications of the air veſſels may be exhibited in a preparation made by maceration. For this purpoſe, the lungs of a dead born child ſhould be procured, and they ſhould be firſt macerated in water till they become ſufficiently putrid to break down the texture of the blood veſſels, cellular membrane, &c. and which ſhould be waſhed away with the finger and thumb, while the preparation is held under water, changing the water frequently as it becomes thick and turbid with the pulpy matter that waſhes off, and that it may be ſeen when the ramifications of the bronchiæ are ſufficiently freed from all extraneous ſubſtance. The preparation is then to be put into ſpirit of wine, diluted with an equal quantity of water.

DCXXVI.

To finiſh the demonſtration of the thorax, it only remains to examine its inveſting membranes, the pleura and mediaſtinum.

DCXXVII.

Pleura.

The pleura is that membrane which lines the inner ſide of the thorax, and covers moſt of its contents. It is a part of conſiderable ſtrength. Externally, its ſurface is cellular, and adheres ſtrongly to the ſurrounding parts. Internally, it is ſmooth, and moiſtened by a lymphatic ſecretion from its veſſels.

DCXXVIII.

It is divided into two ſacs or bags, correſponding to the ſhape of the ſurrounding cavity of the thorax, and its various connections are to the perioſteum of the ribs, to the intercoſtal and ſterno-coſtal muſcles, and to the ſternum and dorſal vertebræ, while it is expanded alſo, as we have ſeen, over the pericardium, the lungs, and the lateral or fleſhy parts of the diaphragm.

DCXXIX.

Behind the ſternum, the two bags of the pleura unite to form a partition, termed the mediaſtinum, which extends between the ſternum and vertebræ, but is intercepted by the heart and root of the lungs, and divides the thorax into two diſtinct cavities, which have no communication with each other.

DCXXX.

The office of the pleura is to ſmooth the internal ſurface of the thorax, and render the motions of the contiguous parts eaſy upon each other, to form diviſions of the thorax for the proper lodging of its organs, and to ſtrengthen its general fabric.

DCXXXI.

Mediaſtinum.

The mediaſtinum, or reflexion of the pleura, is a double membrane, paſſing directly acroſs the the breaſt, and containing between its layers a quantity of cellular ſubſtance, forming the bond of their union.

DCXXXII.

It is divided into two parts, the anterior and poſterior mediaſtinum; the former of which is ſituated at the fore, and the latter at the back part of the thorax; the one being joined to the ſternum, and the other to the pericardium and veſſels of the heart.

DCXXXIII.

At its forepart, the layers of the mediaſtinum are cloſely applied to each other, except where they are ſeparated at the upper part of the cheſt by the remains of the fœtal peculiarity in the ſtructure of the heart, the thymus gland.

DCXXXIV.

To mark the ſituation of the mediaſtinum with preciſion, we obſerve that its upper part lies exactly behind the middle of the ſternum; and that, as it deſcends, it inclines gradually towards the left edge of the bone. From this obliquity, it is found that a pointed inſtrument puſhed through the ſternum, is generally found to enter into the right ſide of the thorax. But this deſcent of the mediaſtinum is by no means regular, as it is at times entirely perpendicular, and at other times its obliquity is to the right, inſtead of the left ſide.

DCXXXV.

On its back part, the mediaſtinum extends from the baſe of the lungs and back of the heart to the vertebræ of the back; and, between the layers of this diviſion of the mediaſtinum, is ſituated the under end of the trachea, the æſophagus, the deſcending aorta, and ſeveral other parts.

DCXXXVI.

The general uſes of the mediaſtinum are to form a diviſion of the cheſt, to ſupport its general contents, to hinder the two lobes of the lungs from preſſing on each other when in a recumbent poſture, and to prevent the paſſage of fluids where they may chance to be collected from diſeaſe, from communicating to every part.

DCXXXVII.

Having thus examined the contents of the thorax, we are now prepared for tracing the circulation of its organs; and, in order to do this, we ſhall begin with examining the action of the heart.

DCXXXVIII.

Action of the Heart.

In its muſcular ſtructure, all the fibres of the heart obſerve an oblique direction; and, in its moſt interior parts, they mix and croſs each other, ſo as to form a ſort of net-work, rendering it in texture the ſtrongeſt muſcle of the body. From this form of its ſtructure, which gives it the greateſt ſtrength, ſo the ſame arrangement gives it alſo the greateſt irritability. It is the part firſt conſpicuous in life, and it is the part which retains longeſt the living ſtate, and this life is even greater on its internal than external ſurface.

DCXXXIX.

The power by which the heart is moved, is the ſtimulus and quantity of the blood, and this quantity muſt be in ſuch proportion as to give a due fullneſs or diſtenſion to its ſeveral parts.

DCXL.

In its action, the heart moves upon its baſis as upon a centre. Its point riſes and curves ſo as to ſtrike againſt the ribs; and the dilatation of the heart is ſuch, that during it, it turns upon its axis one way, and by its contraction, this is reverſed the other way.

DCXLI.

The ſituation of the heart, in all animals, we find determined by that of the lungs, and this ſituation is occaſionally altered in a ſlight degree by diſeaſe, or is liable to be ſomewhat diſplaced. In its ſituation it is ſuſpended by the mediaſtinum and its great veſſels, in its motions it is confined, ſuſtained, and regulated by the pericardium, and for its exertions it depends on its own irritability, and the impulſe of its diſtending fluid, the blood.

DCXLII.

Blood.

The blood is a fluid of a rich colour, varying ſomewhat in its ſhade of red in different veſſels, being florid or vermilion coloured in the arteries, purple or dark red in the veins, and almoſt black at the right ſide of the heart. In its conſiſtence, this fluid is thick and unctuous to the feel, and to the taſte it is ſlightly ſaline and ferruginous. It varies, however, in different parts of the body, and is alſo ſomewhat different in different animals.

DCXLIII.

This fluid is reſolved, as we formerly noticed, into three parts, the red globules, gluten, and feroſity.

DCXLIV.

Red Globules.

The firſt is a part which has much exerciſed the attention of anatomiſts. The red appearance is not general in every animal; but formal particles, correſponding to its ſtructure, though not to its colour, are met with in all animals, and theſe of very different ſizes in different animals. The form of the globules is much undetermined. Theſe globules, when the blood ſtands, fall to the bottom, and they preſerve their form only when in the blood, and are as it were ſupported by the ſerum. In water they are totally diſſolved, and the fluid acquires from this a red tinge. Their proportion to the other parts of the blood is uncertain, and liable to variety, according to the ſtate of the body. They are increaſed by health, vigour, and exerciſe, and they are leſſened by weakneſs and diſeaſe. They are always moſt apparent in the centre of the ſyſtem, and in ſome animals they are only ſeen in the great veſſels round the heart. Though iron is ſuppoſed the cauſe of this colour of the red particles, the point is by no means completely eſtabliſhed, when ſuch a very ſmall portion only is detected, as 1 grain to 400 grains of the fluid.

DCXLV.

Gluten.

The next part of the blood, its gluten, or coagulable lymph, is more important than the former, and is the part of the fluid moſt generally diſperſed through the ſyſtem. It is from this part all the ſolids of the body are formed, and its relation to the body is extenſive and ſurpriſing. It is the baſis of every part that poſſeſſes life. It is ſecreted by the veſſels to repair all the waſte and accidents of the body, and it is, on the whole, that particular form of matter deſigned by Nature for our chief nouriſhment and ſupport.

DCXLVI.

Seroſity.

The laſt part of the blood, or ſerum, is properly its water, blending with it whatever is extraneous, and proper to be diſcharged. It is of a yellowiſh or greeniſh colour, of an unctuous ſlippery feel, ſlightly ſaline and alkaline to the taſte, holding in ſolution a proportion of gluten, and preſerving the red globules in their proper form.

DCXLVII.

From this view, then, the uſes of the three diſtinct parts of the blood are plain. By its ſeroſity is the maſs diſtributed, all extraneous matters removed from it, and the ſeveral ſecretions kept up and regularly carried on; for it poſſeſſes ſufficient dilution to pervade every part, conſiſtence enough to prevent exudation, and ſaline impregnation ſufficient for preſerving the form of the globules. By the red globules is the action of the heart, round which they are accumulated, and the circulation of the large veſſels properly promoted; and, by the gluten, is an ample ſupply furniſhed for repairing the waſte and decay of every part of the ſyſtem. Thus the blood is properly the analyſis of all the fluids. On its gluten depend all the internal ſecretions, and on its ſerum all the external excretions or diſcharges.

DCXLVIII.

With this conſtitution of the blood in view, we are next to examine the extent of the changes induced on it by its oxydation in the lungs.

DCXLIX.

The oxydation of the blood, already noticed, is a proceſs of the firſt importance to animal life. For the perfection of this proceſs alone is the lungs formed, and in order that a conſtant and regular change for the neceſſities of the ſyſtem may proceed. The connection, therefore, of reſpiration with the great principle of life is apparent, and ſtill more ſo, when its effect on the blood is ſeparately examined.

DCL.

The firſt effect of atmoſpheric air, is its brightening the colour of the blood, which none but it and vital air accompliſhes, and in a quantity of blood this only takes place on thoſe parts of its ſurface which are expoſed to the air.

DCLI.

The ſecond effect, along with this increaſe of colour, is giving to the fluid an increaſed ſtimulus, or what we may term the energy of life. This ſtimulus it gradually loſes as it proceeds in its courſe through the ſyſtem, and it requires to be renewed by its tranſition again for this purpoſe to the heart, and from the latter to the lungs. By means of vital air alone, this ſtimulus can be carried to an exceſſive degree, and the animal even deſtroyed by exceſs of excitement.

DCLII.

The third effect of this proceſs is the generation of heat, in conſequence of the increaſed action which the veſſels receive from the new ſtimulus communicated to the blood by reſpiration. This generation of heat, therefore, depends on the diſtribution of oxygen through the body; which, as it enters into combination, gives out the matter of heat; and the ſame thing is alſo aſſiſted by the various proceſſes of the body which convert the gaſeous parts into fluids, and the fluids into ſolids; for by all thoſe different changes heat cannot be given out.

DCLIII.

Theſe effects, then, are accompliſhed by the perpetual and rapid motion of the blood through the lungs; and, in this motion it draws from the atmoſpheric air, to which it is expoſed, that portion of vital air ſufficient for the purpoſe. The proportion of vital air contained in atmoſpheric, is only 27 parts out of the 100; and, of this vital air abſorbed, only one half is depoſited in the circulation. The other, as formerly obſerved, goes to extricate the exceſs of carbon and hydrogen in the ſyſtem, and to diſcharge it by the lungs.

DCLIV.

From this view, the proportion of vital air we employ is but ſmall, as it conſtitutes but $\frac{1}{4}$ part of what we actually breathe; and of that, even one half is immediately diſcharged again from the ſyſtem in combination with the carbon and hydrogen preſent in the lungs. A greater ſupply of it would produce an incitement incompatible with the continuance of life; and, like the rapid movements of a flame, exhauſt the matter to which it is applied.

DCLV.

The movements in reſpiration are ſtrongly influenced by the action of the diaphragm. By this muſcle the belly is protruded, and an enlargement of the thorax takes place, which enlargements occaſions the lungs to deſcend, and gives free acceſs to the air through the trachea to enter their veſicles and diſtend them. By this protruſion of the belly, the abdominal muſcles are next excited to re-act. By their action or preſſure, the form of the diaphragm is reſtored or urged to its natural ſituation, and riſes into the thorax. Thus the cavity of the latter is ſtraitened, the lungs are compreſſed, and the air is again expelled from their cavity. In producing theſe effects, the diaphragm however does not act alone, but is aſſiſted by the thorax, whoſe intercoſtal muſcles are ſubſervient to this purpoſe.

DCLVI.

The animals that do not breathe, it was formerly ſtated, poſſeſs only a ſingle heart, and not any proviſion for the circulation of the lungs; we are naturally led to enquire, after our examination of this organ in man, by what means the circulation of the lungs is diſpenſed with in the child before birth.

DCLVII.

Fœtal Circulation.

In the child, we find the heart perform but a ſingle office; and, in order to do this, both its auricles communicate by an opening paſſing between them, ſo that no quantity of blood paſſes through the lungs more than any other part of common ſtructure, and the ſyſtem of the child is therefore entirely oxydated through that of the mother.

DCLVIII.

The ſtructure for this purpoſe is curious and important. From the placenta of the mother, the maternal blood is tranſmitted by the umbilical vein to the fœtus; and this blood, from the ſyſtem of the mother, muſt poſſeſs a degree of oxydation ſuited to the ſtate of conſtitution of the fœtus. In entering the latter, therefore, that no part of this oxydation may be loſt till it reach the heart, it paſſes in two directions, one part going through the liver of the fœtus, and the other part through the ductus venoſus under the liver, directly to the heart.

DCLIX.

The heart, then, is ſtimulated by this fluid; and, that the lungs may not be called into action, the communication between the two auricles allows it to paſs directly to both ſides of the heart, termed the foramen ovale. The circulation of the fœtus, it is next to be obſerved, is more extenſive than that of the adult, as beſides its own body, the temporary circulation of the placenta muſt alſo be carried on by it. To accompliſh this, and give additional force to its circulation, an appendage is formed to the aorta below its curve by its inoſculation with a branch of the pulmonary artery, named the ductus arterioſus. The aorta, thus increaſed in ſize by this junction, acquires additional force and action, correſponding to what is required for the more extended circulation of the fœtus; receiving the impulſe of the left ventricle through the aorta, and of the right one through the ductus arterioſus.

DCLX.

Thus the blood, after pervading the ſyſtem of the fœtus, is returned in its effete ſtate through the two iliac arteries, reflected along the ſide of the bladder into the placenta to paſs to the ſyſtem of the mother. During pregnancy, therefore, her lungs are required to oxydate her own ſyſtem as well as that of the fœtus, and her circulation is loaded with its own impurities as well as thoſe which the ſyſtem of the fœtus creates.

DCLXI.

From this view, the maternal blood paſſes along the umbilical vein, which adhering to the internal ſurface of the abdomen, enters the liver at the upper part of the cleft which divides this organ into two lobes; and, after entering the liver, it diſtributes branches to the right and left. Next, the ductus venoſus comes off from the umbilical vein, and proceeds in a ſhort curved courſe, joining the largeſt of the hepatic veins, and going directly into the right auricle of the heart.

DCLXII.

Then appears the foramen ovale, the uſes of which are clearly demonſtrated from its ſtructure, for its valve is placed on the ſide of the left auricle, which marks the courſe of its blood. It is of a ſomewhat rounded ſhape, and in its ſituation it lies at the very backmoſt point of the partition between the two auricles. It is placed high up, with a circular ring round its borders, thick and muſcular at its edge, and on the left ſide entirely is placed the valve, perfectly tranſparent and delicate, but ſtrong. This tranſparency remains when it is cloſed after birth; ſo that by this ſtructure, the blood of the fœtus in the heart paſſes immediately from right to left, and into both ventricles; from the left ventricle it is diſcharged into the aorta, and from the right one into the ductus venoſus. This duct is a middle branch between the two great pulmonary arteries, aſſuming their place, receiving the blood, paſſing on alſo in a ſtraight line towards the aorta, and joining immediately below its arch, ſo as to produce a fœtal aorta of double ſtrength and ſize.

DCLXIII.

Such is the courſe of the fœtal circulation. In its office, one heart only belongs properly to the fœtus, and when birth takes place, and reſpiration begins, the double office of the heart then commences. The flow of the blood into the lungs immediately ſtops the circulation of the ductus arterioſus, and the blood entering the left auricle of the heart from the lungs, preſſes down as it fills the valve of the foramen ovale, and completes the partition between the auricles for ever after.

DCLXIV.

Chemical Analyſis of the Blood.

After this view of the circulation, and an account of the blood, it is proper we ſhould next enter into the chemical analyſis of this fluid more particularly.

1. The quantity of this fluid in the body of an adult, is generally rated at 28 lbs.; of this quantity, the proportion in the veins is four parts, and in the arteries only one fifth.

2. The colour of the blood has been already remarked to be florid red in the arteries, and dark in the veins, except in the pulmonary ones. The general colour is ſuppoſed to depend on the preſence of iron oxydated by the lungs. The floridneſs of the arterial blood on the preſence of oxygen, and the darkneſs of the venal blood on the accumulation of carbon,

3. The heat of the blood is about 96 degrees of F. and the arterial blood is warmer than the venal.

4. In taſte, the blood is ſaltiſh, with a ſomewhat urinous ſmell when freſh drawn. In gravity it exceeds water, and in conſiſtence it is glutinous and adheſive.

5. The parts of the blood were already conſidered. When ſubmitted to the action of fire it gives out,

1. Water, ſoon turning putrid.

2. Empyreumatic oil.
3. Ammoniacal ſpirit; and
4. Carbone.

5. The principles of the blood then are;

1. Animal gas or carbonated hydrogene.
2. Cruor; and
3. Albuminous ſerum.

Another principle has been alſo noticed, termed the bileſcent, reſembling in its appearance the cyſtic bile.

6. With theſe remarks on the general conſtitution of the blood, we examine more particularly its ſeparate parts, as divided into cruor and ſerum.

7. The cruor conſiſts of the red maſs concreted into a cake. It forms more than one half the quantity of the blood. It is thick, elaſtic, and glutinous like jelly; and its ſpecific gravity is ten times to that of water. In the temperature of the air it putrifies, and is inſoluble in water. Its ſurface, expoſed to the air, acquires a florid red, which is ſoon loſt by being excluded from it. This depends on its abſorption of oxygen, which has the ſame effect when the blood is contained in a bladder. On being fully ſaturated with oxygen, it blackens by degrees, and its floridneſs can never again be reſtored.

8 The conſtituent parts of the cruor are;

1. The red globules, which conſiſt of fibrous gluten and oxydated iron; the latter in ſuch ſmall proportion, that from 25 lbs. of blood, only two drachms of oxyd of iron were obtained.

2. Fibrous gluten, reſolvable into carbon and azote. This is proved by waſhing the cruor when the red parts

ſeparate in the water, and a white fibrous tenacious maſs is only left.

9. The ſerum of the blood is the lymphatic fluid that ſwims upon the cruor. It poſſeſſes ſomething of a ſaline taſte. It is of a yellowiſh green colour, and forms nearly one half of the blood. With cold water it unites, but with boiling water it coagulates, and a part becomes white. By continuing the boiling it again ſeparates.

10. The principles of the ſerum are;

1. Water; for, from 47 oz. of ſerum, 43 of water are obtained by diſtillation, which ſhows a ſtrong diſpoſition to putreſcency.

2. Albuminous gluten; for, ſtirred with a ſtick, it ſeparates a large quantity of gluten, and the ſame is done by converting it into ice, and by other methods.

3. Jelly; for, when coagulated by heat, the part of the ſerum that does not coagulate, aſſumes in cooling the appearance of a tremulous jelly.

4. Aerated ſoda; as appears by adding to recent diluted ſerum mineral acids, a neutral ſalt being obtained.

5. Culinary ſalt and phoſphorated calx.

11. The albuminous principle, or coagulable lymph, is analagous to the white of an egg. It poſſeſſes neither taſte nor ſmell; is of a white opake colour; is firm in conſiſtence, and by heat it is converted into a horny ſubſtance.

12. Its elementary principles appear to be carbone, azote, and hydrogen.

13. Along with the principles deſcribed, there is alſo

ſeparated from the blood an acriform elaſtic fluid or animal gas. It aſcends from the blood when warm, and received on a glaſs, collects on its ſides like dew. It poſſeſſes a peculiar ſmell, which is ſtrong in carniverous animals; and, when an animal is newly killed in cold weather, it is emitted in the form of vapour.

14. The conſtituent principles of this gas are carbonated hydrogen, as demonſtrated by ſhutting up recent drawn blood in vital air, the vital air being thus converted into carbonic or fixed air, and the hydrogen of the animal gas being converted into water; and, to do this, as we formerly noticed, is one of the chief objects of reſpiration, thus extricating the exceſs of theſe principles from the body.

DCLXV.

We are now led to conſider the circulation from the heart, as it is expanded through the thorax. The aorta, or great artery, from its arch bends downwards and backwards, and touches the left ſide of the ſpine. The two membranes of the pleura we have ſeen meet in the middle to form the mediaſtinum, leaving a triangular ſpace, the baſis of which is the ſpine. The ſides of this ſpace, or membranes of the pleura, incline to each other, and between their interſtice the aorta is lodged, and along with it lies the æſophagus, which runs down, as formerly pointed out, towards the ſtomach, and there alſo lie ſome other parts. The aorta, thus deſcending near the ſpine, gives out the following arterial branches: 1. It gives off ſmall arteries, which nouriſh the proper ſubſtance of the lungs, or the bronchial ones. Next, as it lies by the ſide of the æſophagus, it ſupplies it with ſmall twigs, the æſophageal arteries. Laſtly, in its deſcent, it gives off a ſmall twig to the interſtice of each rib; and theſe are named the intercoſtal arteries.

DCLXVI.

Of theſe arteries, the bronchial firſt claim attention, which are the proper nouriſhing arteries of the lungs, and form a ſet of veſſels diſtinct from the pulmonic ones, which are excluſively appropriated to their oxydation. The bronchial arteries are therefore immediately attached to the trachea, and follow its courſe, or continuation, through all the ramifications of the ſubſtance of the lungs.

DCLXVII.

Arteria Bronchialis Communis.

The firſt branch of them is the common bronchial artery, ſo named from being diſtributed to both ſides of the lungs. It ariſes from the fore part of the aorta, and gives a branch to each ſide of the lungs; beſides which, the right branch gives a veſſel to the æſophagus, and ſometimes it paſſes itſelf entirely to this part.

DCLXVIII.

Arteria Bronchialis Dextra.

Like the former, this ſometimes originates from the aorta, but oftener from the upper intercoſtal artery. It proceeds round the right branch of the trachea; and it is confined alone to that ſide of the lungs. Several branches are alſo ſent off by it to different parts, as to the æſophagus, back of the pericardium, and the ſame part of the mediaſtinum.

DCLXIX.

Arteria Bronchialis Siniſtra.

The origin of this veſſel is the fore part of the aorta, whence it deſcends with the bronchialis communis. It proceeds to the left ſide of the lungs, and gives off ſome branches to the neighbouring parts.

DCLXX.

Arteria Bronchialis Inferior.

This artery is not always met with; but when it occurs, it ariſes from about the place of the fifth rib. It proceeds to the back part of the heart, above the left pulmonic vein, is extended into the auricle, and along with it paſſes into the ſubſtance of the lungs.

DCLXXI.

Such are the bronchial arteries. In their origin, as we have deſcribed, they are irregular, proceeding in different caſes from the aorta, mammary artery, or upper intercoſtal one, and not unfrequently from the intercoſtals of the aorta.

Their number of branches, however, is generally four, and their office is clear and eſtabliſhed.

DCLXXII.

Arteriæ Æſophageæ.

Theſe arteries ariſe from the aorta, below the former. They encircle the æſophagus in the form of ſmall twigs, five or ſix in number; and they anatomiſe in their courſe with each other. From the æſophagus they proceed to the back of the mediaſtinum, and being joined by ſome ſmall branches from the aorta, they form what have been named the poſterior mediaſtinal arteries.

DCLXXIII.

Intercoſtales Inferiores.

The number of the lower intercoſtal branches varies with the number of ribs they ſupply. This depends upon the extent of the upper intercoſtal artery, which generally ſupplies two, and ſometimes three upper ribs. The lower intercoſtal arteries, therefore, are generally nine or ten in number; they are given out from the aorta in its deſcent along the ſpine, and it apportions one as it paſſes each vertebra for each rib. Hence they are properly termed intercoſtals in the thorax and lumbar arteries in the loins. On the right ſide they are longer than on the left, from the ſituation of the aorta with reſpect to the ſpine; and, beſides ſupplying the ribs, theſe arteries give off ſmall branches to the œſophagus and mediaſtinum.

DCLXXIV.

. The diſtribution of each intercoſtal artery in its courſe is extenſive.

From the head of each rib it gives off three ſmall branches to the ſpine. One for the ſubſtance of each vertebra; one for the ſheath of the ſpinal marrow; and one for the ſubſtance of the ſpinal marrow itſelf. Near the head of each rib a large branch is next ſent off, perforating to the back, and giving circulation to the large muſcles there, which it ſolely ſupplies.

In the extent of the rib, the intercoſtal artery gives off numerous ſmall branches to the intercoſtal muſcles; and it alſo, in its courſe, divides into two branches, one of which is large, and attached to the lower edge of the rib above it, and circulating in a groove for that purpoſe. The other, ſmaller, adheres to the upper edge of the lower rib. In their progreſs, both advance to the fore part of the thorax, and inoſculate with the mammary and epigaſtric arteries.

DCLXXV.

In this way is the circulation of the thorax conducted. The pulmonary veſſels divide into two branches, which, like the bronchial, paſs to right and left, and are diſtributed on the lungs. --The minute branches running in the common cellular ſubſtance, form at laſt a plexus upon the proper cells, from which the halitus is derived, expelled by the lungs in expiration. The pulmonary veins, which return the blood from the lungs to the left auricle of the heart, are ſmaller in proportion to their correſponding arteries, than the veins are to the arteries in other parts of the body, which has been aſcribed to the large quantity of fluids expired; and perhaps, alſo, that the blood may be longer detained in its paſſage from the lungs, and, of courſe, longer expoſed to the action of the atmoſphere. Theſe veins, however, join into four principal trunks, terminating all in the left auricle.

DCLXXVI.

Such is the arterial circulation of the thorax. Theſe arteries deſcribed, poſſeſs all their correſponding veins. Thus the bronchial arteries return their blood by theſe veins to the azygos, and left ſuperior intercoſtal vein. In the thorax, no very great arterial branches ariſe from the aorta, or are given off for its circulation. It is, when it paſſes through the thorax above and below, that its largeſt branches are diſtributed, and the circulation of the thorax is confined chiefly to the four we have deſcribed. The coronary arteries for the heart itſelf; the bronchial and pulmonary veſſels for the lungs; the æſophagial arteries for that part; and the inferior intercoſtals for the ribs and ſpine.

DCLXXVII.

Having thus examined the organs of the thorax, proceeding downwards, we are led next to thoſe that fill the abdomen, beginning with their general inveſting membrane, the peritonæum.

DCLXXVIII.

Peritonæum.

The peritonæum is the inveſting membrane of the abdominal cavity, which appears on removing the muſcles, and is ſpread round the bowels, and partly ſupports them. It is a firm ſimple membrane, highly elaſtic, and admits of great extenſion, as is proved both in pregnancy and diſeaſe. When the cauſe, alſo, of extenſion is removed, it regains its former dimenſions.

DCLXXIX.

Like that of the other membranes already examined, its two ſurfaces differ. The external one is rough and cellular, ſo as to connect itſelf cloſely with the parts to which it is in contact The internal one is ſmooth, ſlippery, and lubricated by an exhalation from its own veſſels.

DCLXXX.

ent of this membrane is very conſi-
t forms the lining of the diaphragm,
own, covering the abdominal muſcles.

It next lines the pelvis and its contained parts. It is then reflected back, and covers the muſcles; and laſt, by its reduplications, it is expanded over the bowels and great blood veſſels of the whole cavity. In its paſſage to different bowels, doublings are formed by it, which ſerve as ligaments to attach them to each other, and likewiſe to ſuſpend them to the body.

DCLXXXI.

Thus the peritonæum affords to moſt of the bowels a general covering, and only where they are very deep ſeated, does it appear to be partial. By its expanſion, a large ſac is formed; which, on the back part, is bounded by its adheſion to the different viſcera; and before, is confined by the abdominal muſcles. Being looſe, however, upon the contents of the cavity, it allows them ſome freedom of motion.

DCLXXXII.

The external ſurface of this membrane is covered with cellular ſubſtance, which varies in its thickneſs and manner of attachment in different parts. On the bowels it is extremely thin. In other places, as the kidneys, it is filled with a conſiderable quantity of fat; and, in particular ſituations, as on the ſpermatic cords, it ſends off various proceſſes without any interference with the internal membrane, being unaccompanied by it.

DCLXXXIII.

Thus the uſes of the peritonæum are extenſive and important; and, beſides thoſe which have been obſerved of incloſing, ſupporting, and connecting the different parts, it prevents any injurious effects from friction by the ſmoothneſs and lubricity of its ſurface.

DCLXXXIV.

With this demonſtration of their covering, we proceed to the examination of the bowels within the peritonæum, which we find ſerving three different purpoſes: viz.

Thoſe that ſerve for the reception or preparation of the aliment, ſo called the chylopoetic viſcera, or the ſtomach and alimentary canal; as alſo other viſcera that are aſſiſting to this, and which pour in liquors, as the liver and pancreas, and we ſhall perhaps find it probable that the ſpleen is ſubſervient to the liver in preparing the bile. When the chylopoetic viſcera are removed, we find the urinary organs, and at the undermoſt part of the general cavity we find the organs of generation; and, to allow an eaſy motion, we ſhall find a quantity of fat, and an organ named om[illegible] we commence our detail with the [illegible] leaving the examination of this part, the [illegible] ſhall afterwards.

DCLXXXV.

Stomach.

The ſtomach is a large membranous bag, placed under the diaphragm. In its figure it is ſomewhat oblong and round, and has been compared in ſhape to the appearance of a bag-pipe. It is turned downwards and forwards, ſo as to form an angle with the æſophagus, and this angle is increaſed by the diſtenſion of the organ.

DCLXXXVI.

The ſize of this organ is various, and much proportioned to the quantity of aliment the individual is accuſtomed to receive. Hence it is larger in men than in women, and in the former is frequently increaſed by mode of life to an enormous ſize.

DCLXXXVII.

This organ has been divided by anatomiſts into a variety of parts, and the firſt that claims attention are its two orifices. The former, the left, or upper orifice, conſtitutes the termination of the æſophagus, and it is named the cardia. It is oppoſed to the ſpine, at a little diſtance from it. It allows a free paſſage for the blood into the organ, the return of which is prevented by the angle of the ſtomach at this part, and by the fleſhy ſtructure of the cardia and the diaphragm, in which it is ſituated. The latter, the right, or inferior orifice, is turned from its office to diſcharge the contents, pylorus, and forms the commencement of the duodenum or inteſtines. Its ſituation is a little to the right ſide of the ſpine, under the ſmall lobe of the liver, and it is turned more forwards than the upper orifice, though its ſituation is altered ſomewhat by the particular ſtate of the organ.

DCLXXXVIII.

The ſecond part of the ſtomach that claims attention, are its ſurfaces, the upper one turned towards the diaphragm, the under one towards the inteſtines; but, when the abdomen is opened, the ſuperior ſurface appears anterior, and the inferior ſurface poſterior, ſo that they only deſerve the former appellations when the ſtomach is conſiderably diſtended.

DCLXXXIX.

The curvatures of the ſtomach form its next diviſion, being divided into two, the large and ſmall one. The large curvature extends from the one orifice to the other, is placed towards the abdominal muſcles, and is turned obliquely forwards and downwards. The ſmall curvature is oppoſite to this, extends alſo between the orifices, and is placed towards the ſpine, and in a direction [illegible] and upwards.

DCXC.

After tracing theſe different diviſions of the organ, its general ſtructure falls to be conſidered. From its connection above, it muſt be regarded ſimply as an expanſion of the æſophagus; but, from its peculiar office, it appears poſſeſſed of certain additional powers for the alteration of its contents. Holding this in view, we find it, when ſubjected to examination, diviſible into four diſtinct layers or coats.

DCXCI.

The firſt, or external coat, is evidently derived from the peritonæum, being a reflection of it from its expanſion on the liver. By this coat, the ſtrength of the organ is increaſed. The effects of friction are diminiſhed, and the ſenſibility of the other parts which expoſe it to pain, or inflammation, are greatly leſſened. Between this coat and the next, there is interpoſed alſo a quantity of cellular ſubſtance, which aſſiſts in the ſame general effect of increaſing its ſtrength and diminiſhing its ſenſibility, and forms the medium of connection with its internal layers. This part has ever been deſcribed as a ſeparate covering.

DCXCII.

The ſecond, or muſcular coat, is a more important one, and it conſiſts of fibres variouſly diſpoſed, but chiefly longitudinal and tranſverſe.

The longitudinal fibres are evidently continued from thoſe of the æſophagus, which extending to the ſtomach, are diſſeminated in various directions, but they chiefly follow the general courſe of the organ from the upper to the under extremity. Upon each ſide of the ſmall curvature, in particular, they form a thick, ſtrong, muſcular band.

The tranſverſe fibres are thoſe peculiar to the organ. They are conſiderably thicker and ſtronger than the former, and they are alſo placed more internal. By this muſcular coat, the organ is endowed with much power of action, and in proof of it, we find from continued cauſes of irritation, that the cavity of the organ comes to be much contracted in conſequence. It is by means of this coat, that what is termed the vermicular motion of the ſtomach takes place; for, at the left orifice it begins to contract, and proceeds with a regular and circular motion, each part contracting in order, and laſt of all the pylorus; and, in this motion, the one ſet of fibres ſhorten the organ, while the other renders it narrower; and this ſecond ſet is even interſected by many ſmall tendinous diviſions, which, limiting their extent, increaſe their power.

DCXCIII.

[illegible] d coat, is what is termed the nervous [illegible] which is formed by a modified expanſion cellular texture, and compoſes as it were a bed for the connection and circulation of the inner coat or proper one of the organ, on which its peculiar function, or epigaſtric ſecretion, more immediately depends. It is therefore intimately connected with the inner coat, poſſeſſing many ſmall aponeuretic filaments which croſs each other obliquely, and intermix to ſupport the connection.

DCXCIV.

The fourth, or villous coat of the ſtomach, is of a complex texture. It poſſeſſes a ſtructure ſimilar to that of the internal ſurface of the æſophagus, for the ſeparation of mucus, to ſheath the organ from irritation, or the too powerful action of its contents, and it poſſeſſes beſides a peculiar ſet of veſſels both for ſecretion and abſorption. It is formed of fine ſhort, prominent villi, highly vaſcular, and largely rugated or divided into folds. The extent, therefore, of the inner coats, is much greater than the outer, and the peculiar ſtructure of the rugæ is their leading diſtinction.

DCXCV.

Theſe rugæ run for the moſt part in a waving tranſverſe direction, and theſe divide into a ſort of net-work, or reticulated ſtructure. They yield to diſtenſion; and are moſt diſtinct when the ſtomach is in an empty ſtate; and, by this diſtenſion, it is probable the ſtimulus of action is given to their veſſels. By this folded ſtructure, therefore, their veſſels are fitted to expand without injury, and the aliment is detained longer upon their ſurface in its progreſs through the organ.

DCXCVI.

From the inner ſurface of the ſtomach proceeds a peculiar fluid, approaching in its nature to the ſaliva, termed the gaſtric juice. The origin of this fluid is evidently from the internal coat, and on the preſence of this fluid the peculiar function of the ſtomach depends.

DCXCVII.

Chemical Analyſis of the Gaſtric Fluid.

That proceſs, termed *Digeſtion*, by which the contents of the ſtomach are converted into chyme, or the foundation of nouriſhment, is chiefly effected by this fluid.

1. When examined, it is limpid like water, or occaſionally tinged with the yellow colour of the bile. It has no ſmell, and poſſeſſes ſomething of a ſaltiſh taſte.

In its gravity it is lighter than the blood, and is ſomewhat viſcid from its mixture with mucus, being ſeldom procured in a pure ſtate.

In its nature it varies in different animals, and ſhews alſo different powers.

In the graminivorous animals, it turns the ſyrup of violets green, and does not act on animal food with activity.

In the carnivorous tribe, it turns the ſyrup of violets red, and ſhews little action on vegetable food.

In man, the colour of the ſyrup is not altered by it, and it acts equally on food of both kinds.

2. This fluid readily unites with water, is only precipitated by alcohol, and reſiſts putrefaction in an eminent degree. The peculiar quality it poſſeſſes is the coagulation of milk, and ſo ſtrongly does it retain this property, that the ſtomach dried and waſhed, poſſeſſes ſtill the ſame quality.

3. The conſtituent principles of this fluid, as far as yet detected, we find to be;

a. Water, which conſtitutes its greateſt portion.

b. Albumen, as precipitated by alcohol.

c. Culinary ſalt, detected by chemical analyſis.

d. Uncombined phoſphoric acid, which is never wanting.

4. An artificial gaſtric juice, it is ſaid, has been formed by macerating freſh fleſh in a ſolution of culinary ſalt.

5. The gaſtric fluid acts independent of the ſtomach and food, in metal tubes is digeſted by it. In a proper temperature, chyme is alſo formed by it out of the body. It alſo acts on the ſtomach itſelf, ſo ſoon as the extinction of the vital principle takes place.

7. The proceſs of digeſtion, therefore, may be termed an animalizing ſolution, aſſiſted by heat, and hardly by triture.

DCXCVIII.

INTESTINES.

The termination of the ſtomach takes place in a long cylindrical canal, which winds in various directions. The commencement of this canal is at the pylorus, or under orifice of the ſtomach, and this orifice is formed by the reflected doubling of the two inner coats which project into the paſſage between the ſtomach and inteſtines, and form a ring of muſcular fibres that compoſe a ſphincter, termed the ſphincter of the pylorus. The inteſtinal canal then deſcending from this ſphincter, occupies a large part of the abdomen, and contains in its various convolutions a length, ſuppoſed equal to ſix times the length of the body in its ordinary ſize. This proportion, therefore, is greater in thoſe of a diminiſhed ſtature, than in others. To the body the inteſtines are connected, or held in their place by their peritoneal covering; and, in their progreſs from their different dimenſions or capacity, at different places, they have been arranged into two general diviſions, the ſmall and large inteſtines.

DCXCIX.

Small Inteſtines.

The ſmall inteſtines diſplay externally a ſmoothneſs of ſurface, and taper ſomewhat in their form, or gradually leſſen in their diameter from their upper to their under extremity. They admit a diviſion into three parts, of the duodenum, jejunum, and ilium.

DCC.

Duodenum.

The duodenum, ſo termed from its length, ſuppoſed equal to 12 fingers' breadth, poſſeſſes the ſame ſtructure as the æſophagus and ſtomach, from which it begins. In its courſe, it paſſes firſt on in a tranſverſe direction to the right ſide, and goes ſomewhat backwards, as far as the neck of the gall bladder, having the anterior layer of the omentum fixed to its inferior part, and the leſſer omentum to its oppoſite ſide. It then proceeds obliquely downwards to the right ſide, before the great veſſels that go into the liver, and before the venal artery and vein, included in the cellular part of the meſocolon. Oppoſite to the under part of the kidney, it turns to the left ſide to be lodged in the common root of the meſocolon and meſentery, and receives into its back part the extremities of the biliary and pancreatic ducts, going over the aorta and vena cava oppoſite to the laſt vertebra of the back. From theſe veſſels it makes another curve towards the right, being involved in the root of the meſentery, and getting afterwards to the left ſide of the ſpine, it perforates the meſentery and meſocolon, and makes a turn forwards, when it receives the appellation of jejunum.

DCCI.

Jejunum.

The jejunum, beginning at this part, derives its name from being generally the emptieſt of the inteſtines, in conſequence of the thinner part of its contents being ſooner abſorbed. It begins at the laſt turn of the duodenum, is redder than the other parts, and its numerous convolutions, which run in all directions, are confined to the upper part of the umbilical region.

DCCII.

Ilium.

The ilium, the next diviſion, is diſtinguiſhed externally from the former by its ſmaller ſize, and the greater thinneſs and paleneſs of its coats, and in its extent it forms about $\frac{3}{5}$ of the length of the two inteſtines. Its name is derived from its numerous convolutions, which extend from the under part of the umbilical over the hypogaſtric and iliac regions, not unfrequently into the pelvis. In this extent it ſurrounds the lateral parts of the former diviſion, and is ſupported by the oſſa ilia. In its laſt turn, paſſing acroſs the upper edge of the iliac bone, it terminates in a valve at the beginning of the colon.

DCCIII.

Such is the general courſe of the ſmaller inteſtines, and it is not very neceſſary to diſtinguiſh that part of them named jejunum, from its being ſuppoſed to be empty of chyle, from that part named ilium, and phyſicians ſeldom make the diſtinction, comprehending both parts under the name of ilium, ſo they call it an iliac paſſion, whatever part of the gut may be affected.

The inteſtines are nearly, but not altogether, of a cylindrical ſhape when diſtended, their coats are thin, and as we go down they gradually become more pellucid.

DCCIV.

Thus the diviſion between the ſmall and great inteſtines is made by the ilium paſſing into a great ſack, which makes the beginning of an inteſtine, named very univerſally the colon; this enters the caput coli nearly at right angles, when the colon is lengthened out ſome way, and is lodged in the hollow of the os ilium, and this we would name the caput cæcum coli; and from that part goes off the appendix vermiformis.

DCCV.

Great Inteſtines.

In their form, the great inteſtines reſemble the ſmall ones. They compoſe one continued canal, which gradually leſſens in dimenſions from its upper to near its under extremity, but in their ſize they greatly exceed them, and in their courſe they are alſo ſhort and ſtraight, compared with the ſmall inteſtines. Their external ſurface diſplays an irregular appearance; they are locked up into cells, and a number of proceſſes ariſe from them. They admit, however, a ſimilar diviſion to the ſmaller inteſtines, and are compoſed of three parts, the cæcum, colon, and rectum.

DCCVI.

Cæcum.

Under the inſertion of the ilium lies the cæcum, or blind gut, conſiſting of a ſhort bag, three fingers' breadth long, and of the ſame diameter, extending to the dilated beginning of the colon. Its ſituation is the right iliac region, under the iliac convolutions, and reſting on the cavity of the iliac bone, at the under extremity of the right kidney. It is placed ſo that its bottom deſcends, forming a ſhut ſac, with its mouth turned towards the colon, termed the caput cæcum coli. On the poſterior part of the cæcum, there is alſo a ſmall proceſs, in its diameter about the ſize of a gooſe quill, and hardly more than two or three inches long, named the appendix vermiformis. It diſplays a convoluted ſtructure, fixed by its ſides to the cæcum, with two extremities, one impervious, and the other with an oblique opening into the back part of the gut.

DCCVII.

Colon.

The colon, the next diviſion, exceeds in length all the other inteſtines. It is a production of the cæcum, beginning at the termination of the ilium, it encircles the ſmall inteſtines, and is in contact with moſt of the abdominal viſcera. Hence its courſe is complex, and variouſly convoluted. It riſes in the right iliac region over the kidney, to which it is connected, and reaches the height of the angle of the right hypochondrium. It then runs tranſverſely under the liver and ſtomach, eſpecially to the ſpleen, in doing which, this part of it receives the name of the great arch of the colon. In the left hypochondrium, it turns backwards under the ſpleen, and deſcends on the fore part of the kidney, to which it is connected. In this ſituation it forms two convolutions, compared in ſhape to the Greek ſigma, and thence named its ſigmoid flexure. The length of this flexure varies in different caſes, extending at times as far as the cæcum. Through its whole extent, this inteſtine is fixed to its ſituation by the meſocolon.

DCCVIII.

Rectum.

From its ſtraight ſituation when viewed anteriorly, the name of the laſt diviſion of the inteſtines, or the rectum, is derived. Its ſituation is the loweſt of the lumbar vertebræ, and it deſcends in its progreſs upon the fore ſide of the os ſacrum and coccyx, terminating in the anus, a little beyond the extremity of the laſt bone. Its courſe is regulated by the direction of the bones, over which it paſſes. Thus it is inclined ſomewhat downwards at its riſe, then a little backwards, and afterwards turns forwards. It differs from the other inteſtines in becoming wider in its progreſs downwards, and forming below a reſervoir for the fœces. Its termination is named the anus, where it contracts into a narrow orifice, the ſides of which are diſpoſed in cloſe longitudinal folds. The rectum is fixed to its ſituation by means of the meſo-rectus.

DCCIX.

In this account of the inteſtines, ſome ſmall parts remain to be detailed. The firſt are the apendiculæ pinguedinoſæ, ſituated on the outer ſurface of the great inteſtines, particularly the colon, at different diſtances from each other, and projecting from the inteſtines like ſo many pendulous papillæ, the uſe of which is evidently to lubricate theſe parts. Of the ſame nature, alſo, are the adipoſe ſtrata in the ſides of the adheſions of the meſocolon. The ſurface of the colon is alſo interſected longitudinally through its whole courſe, by certain ligaments like bands, which appear to divide it into three parts. One of them extends along each ſide of it, and the third is concealed by the attachment of the meſocolon.

DCCX.

After the ſtomach and inteſtines, what we may term their appendages, or the meſentery and omentum, fall to be examined, the former ſerving to connect the inteſtines to their ſituation, the latter to lubricate the cavity over which they are ſpread.

DCCXI.

Meſentery.

The meſentery is a reflected production of the peritonæum, which detached, includes the inteſtines as in a ſling; and, from its ſituation with reſpect to them, is it named. It conſiſts of three parts; one uniting the ſmall inteſtines, which receives the proper name of meſentery; another connecting the great inteſtines, termed meſocolon, and a third attached to the rectum, named meſorectum.

DCCXII.

Proper Meſentery.

The firſt part begins at the laſt turn of the duodenum, running obliquely downwards to the right ſide, and along the vertebræ of the loins, to the three firſt of which it is connected. Between its layers are incloſed cellular ſubſtance and much fat, and the veſſels and nerves of the jejunum and ilium take the ſame direction. From the convolutions of the inteſtines, with which it correſponds, the extent of its anterior edge is much greater than its poſterior one, being formed into plaits or folds.

DCCXIII.

Meſocolon.

At the lower extremity of the ilium, the meſocolon, the ſecond diviſion of the meſentery, and its continuation, begins. It is here contracted in ſize, and following the courſe of the great ſtines, they are fixed by it in their place. Under the right kidney it forms the right ligament of the colon, becoming for this purpoſe narrow and firm. Next, by the immediate adheſion of the colon to the kidney and duodenum, there is an apparent want of meſo-colon oppoſite to this place. From this turning acroſs, in order to incloſe the arch of the colon at its anterior edge, it forms a broad expanſion, and behind it is fixed to the ſpine, firſt ſeparating and incloſing the anterior part of the duodenum. On the left ſide, the firſt connection of the meſocolon is to the under part of the left extremity of the ſtomach, and deſcending over the left kidney, it forms at its under end the left ligament of the colon. It then forms an adheſion to the large pſoas muſcle, expanding for this purpoſe, and the ſigmoid flexure of the colon is retained in a looſe fold of it.

DCCXIV.

Meſorectum.

The meſorectum, or laſt diviſion of the meſentery, begins with the loweſt vertebra of the loins. Then it contracts by degrees, becomes narrow, and diſappears at the under part of the pelvis, at which part the rectum forms an immediate attachment to the os ſacrum.

DCCXV.

Thus the office of the meſentery ſerves to ſuſpend, to connect, and retain the ſeveral inteſtines in their proper ſituation, to afford them an external coat, and to allow a proper diſtribution of their circulation.

DCCXVI.

Omentum.

The omentum is a fatty membrane expanded over a large portion of the abdominal viſcera; and, in conſequence of this expanſion, it admits of three diviſions into the omentum of the ſtomach, liver, and colon.

In youth, in its form, it compoſes a diſtinct bag, but becomes connected and reticulated by age. It is diviſible in its ſtructure into layers, the outer of which is a peritoneal covering reflected from the ſtomach.

DCCXVII.

The anterior layer of the firſt omental diviſion, is a continuation of the peritoneal coat which externally covers the ſtomach, and is extended here from its upper and under ſurfaces. From its origin it is ſpread over the bowels, reaching as far as the ſpleen, and deſcending a little below the umbilicus, eſpecially in fat people. It poſſeſſes, however, no adheſion to the abdominal muſcles immediately behind which it is placed. At the under edge it is reflected, and aſcends, forming he poſterior layer. In this aſcent it forms no adheſion till it reaches the arch of the colon, to which, and to the veſſels of the ſpleen, it is connected.

DCCXVIII.

The ſecond diviſion of the omentum ariſes from the arch of the colon, in the ſame manner as the former part does from the ſtomach, and is connected to the cæcum by a particular cunciform proceſs.

DCCXIX.

The third diviſion, or hepatic omentum, receives various appellations, and is rather a membrane from its poſſeſſing little fat in its compoſition. It is connected to the ſmall curvature of the ſtomach at its edge, and to the beginning of the duodenum; and, for this purpoſe, it paſſes to the under and back part of the liver, from the fore part of the ſinus of the aorta. In its ſtructure, like the other parts, this diviſion of the omentum conſiſts of two layers, but has no reflexion upwards. On reaching the ſtomach, a diviſion of its layers takes place; and, by this diviſion, they take a direction ſo as to incloſe the organ, and form its external coat. On gaining its great curvature, however, their reunion takes place; and, by this reunion, they paſs on to form the anterior and reflected portion of the firſt diviſion, while this reflected part ſeparating again, cloſes over the colon to form its external covering, and then uniting at its oppoſite ſurface, is continued under the name of the meſocolon.

DCCXX.

By this diſtribution, the third diviſion appears the original and moſt expanded part, and by it an irregular bag or cavity is formed, containing the hepatic omentum, ſtomach, and firſt diviſion of the omentum in its anterior part; and the reflected portion of the firſt diviſion, the colon, and meſocolon in its poſterior part.

DCCXXI.

At the upper and right ſide of this ſac, or behind the cord which leads to the hepatic veſſels, is ſituated the ſemicircular paſſage, formed of two ligaments from the peritonæum, termed Winſlow's foramen, equal to a finger in ſize, and maintaining a communication between the large ſac of the omentum, and the common cavity of the abdomen, ſo as to allow fluids to paſs readily from the one to the other.

DCCXXII.

The evident uſe of the omentum, from its fatty nature, is to lubricate the bowels, and prevent injury from friction.

DCCXXIII.

Having thus examined, in a general way, the appearance and ſituation of the chylopoetic viſcera, we ſhall now conſider, firſt, their general circulation; and then review the leading circumſtances of their ſtructure.

DCCXXIV.

From the thorax, the aorta deſcends under the arch formed by the legs of the diaphragm into the abdomen. When it has paſſed, it directs its courſe pretty near the middle of the vertebræ, embraced by the tendinous arch of the diaphragm. In this courſe it wants the cava, which, on leaving the pelvis, inclines to the right ſide, and paſſes under the liver in order to reach the right auricle of the heart.

DCCXXV.

In its progreſs the aorta forms numerous connections. Its firſt branch attaches it to the meſentry, and in the ſame way to the thoracic duct. Its other branch attaches it to a number of large nerves deſcending to be diſtributed on theſe parts. On proceeding into the abdomen, it firſt diſpenſes a ſmall arterial twig to the diaphragm; it then gives off the cæliac artery which ſupplies the liver, ſtomach, and ſpleen. Its next branch is ſent off for the circulation of the inteſtines, named the great meſenteric artery; and its laſt diſtribution is made to the lower inteſtines by the lower meſenteric artery. The particulars of this diſtribution it is next proper to trace.

DCCXXVI.

Arteriæ Phrenicæ.

The circulation of the diaphragm, we find, depends on two arteries named phrenicæ, which paſs one to each ſide of it. In the ſituation, however, and number of theſe arteries, there is conſiderable variety, as at one time they take their origin from the aorta at different places of it, at another time they ariſe partly from the aorta, and partly from the cæliac artery. They are generally two, but ſometimes they are found to be increaſed to three or four. In their moſt common number and progreſs, one goes round each ſide of the diaphragm, and each croſſing the fleſhy part of the crus of its own ſide, bends along to the ala or wing, from which it gives in all directions a greater number of branches to the fleſhy ſides of the diaphragm. From the wing, it then turns round and encircles the great central tendon; and, before this, each artery gives off one large branch to the fleſhy ſides of the diaphragm ariſing from the ribs. All their remaining branches are then ſpread on the central tendon and ſternal part of the muſcle, inoſculating largely together in theſe ſituations. One branch from theſe arteries is alſo ſent often to the pericardium, when it is connected with the diaphragm.

DCCXXVII.

Before paſſing into the diaphragm, the phrenicæ give ſmall branches to other parts, particularly to the renal capſules and œſophagus. Beſides the phrenic arteries, the diaphragm is alſo ſupplied by branches from the intercoſtal, lumbar, and capſular arteries, as well as from the thorax.

DCCXXVIII.

Arteria Cœliaca.

The next, and a very important artery, is the cœliac. Its origin is from the fore part of the aorta, under the 11*th* vertebra of the back, and where the courſe of the diaphragm embraces it in the form of a thick ſhort tube, encircled by the leſſer arch of the ſtomach. It then immediately divides into three branches, the middle one of which goes to the ſtomach, the left to the ſpleen, and the right to the liver. Of theſe, the ſmalleſt is the middle one, the largeſt in the adult the left one, but in the fœtus the right one.

DCCXXIX.

Arteria Coronaria Ventriculi.

This central cœliac branch is about the ſize of a crow quill. It riſes upwards, and turns a little towards the left ſide from the ſituation of the pylorus; but, before reaching this orifice, it is divided into two great branches, one encircling the cardia, the other diſtributed along the leſſer arch.

DCCXXX.

Arteria Coronaria Superior.

At its riſe from the diaphragm, the æſophagus receives this cardiac branch, which turns round it, and, after various convolutions, appears on the left ſide of the ſtomach, over which it is ſpread. In the middle of this courſe it gives off a branch, which purſuing the baſe of the poſterior ſurface of the æſophagus, paſſes into the thorax, and unites with the upper æſophagean arteries.

The ſecond is a continuation of the ſame cardiac branch, ſending its ramifications down over the large part of the ſtomach, ſomewhat in the ſhape of a crown, and ending in its inoſculation with the vaſa brevia from the ſpleen.

The ſecond branch diſtributed along the leſſer arch of the ſtomach, as formerly noticed, may be ſaid properly to be the right diviſion of the former. It turns from the root of the æſophagus round the leſſer arch, bending according to its curvature, and diſtributing branches down, both forwards and backwards, over each ſide of the ſtomach. By theſe branches on the ſtomach it runs to be ſpent, and arrives with a very ſmall trunk at the pylorus. From the ſtomach, it turns upon the ſmall gut, or continues its connection to both, and is named arteria pylorica ſuperior.

Several other arteries are diſtributed on the ſtomach from the other organs, which fall to be afterwards noticed, when treating of theſe organs.

DCCXXXI.

Arteriæ Meſentericæ.

The next arteries are the meſenteric, or thoſe that ſupply the inteſtines, and they are ſo named from lying within the two layers of the meſentery. The firſt, or ſuperior, gives its branches to the colon and the ſmall inteſtines. The ſecond, or inferior, attaches itſelf to the left ſide, and ſupplies the lower part of the colon and rectum.

DCCXXXII.

Superior.

The former is the largeſt of the abdominal arteries. Its origin is not more than half an inch below the cœliac artery, from that part of the aorta betwixt the legs of the diaphragm. It then paſſes under the pancreas, and through the meſocolon or the proper meſentery of the ſmall inteſtines. The firſt turn is to the left, and then to the right ſide of the abdomen, and on getting low into the abdomen, it gives off ſeveral branches. To the right it gives three principal branches, but to the left they are ſo innumerable, as not to admit any particular detail; and their inoſculations are ſo great, as to form a plexus carrying the artery down to the left ilium, where the conjunction of the ilium with the colon lies. The principal branches it gives to the right ſide, viz. the colico-media, dextra, and ilio-colica.

DCCXXXIII.

Colica Media.

The firſt paſſes between the two lamellæ of the meſocolon, and divides into two great branches before reaching the inteſtines, one turning back along the right ſide of the colon, and inoſculating with the colic arteries; the other turning upwards, and bending according to the curvature of the arch of the colon, till after rounding it to the left ſide, it inoſculates with the left colic artery, or branch of the inferior meſenteric.

DCCXXXIV.

Colica Dextra.

This branch is ſometimes ſeparate, but more commonly its origin is from the middle colic artery. It is a large branch ſet off at a crooked angle. Its courſe is along the right ſide of the colon, dividing as it approaches the inteſtine into two branches, one turning upwards to join the middle colic artery, the other paſſing downwards to attach itſelf to the ilio-colic artery.

DCCXXXV.

Arteria Ilio-Colica

Is a long ſmall artery, ariſing about an inch below the laſt, and paſſing to that part where the ſmall inteſtines terminate, and the large ones begin or run along the meſentery towards the joining of the ilium with the colon. It terminates in three regular branches, one paſſing ſtraight on to the junction of the ilium and colon, divides there into two leſſer branches; one of which traverſes the fore, the other the back part of the caput cæcum, being connected with the valve within:—another branch runs backwards along the colon, and inoſculates with the right colic artery; and a third runs down along the ilium to join the branches of the meſenteric artery. It is from theſe diverging branches this artery is ſo named. The appendix vermiformis has alſo a meſentery tying it down, and from the caput coli an artery runs down to ſupply this meſentery, pervading the whole length of the proceſs.

DCCXXXVI.

Theſe, then, are the branches of the meſenteric artery to the right; to the left, they are ſo numerous as to form a great net-work of ſmall arteries for the ſupply of the ſmall inteſtines. The firſt, or radical branches, are from 12 to 20 in number, thick, ſhort, and large. From theſe, ſecondary ramifications ariſe equally numerous; and from the laſt, farther ones take their origin. Each of theſe ſets inoſculate with each other, mouth to mouth, in the form of arches, and, in the end, from the laſt of theſe inoſculating plexus, the arteries go out ſtraight upon the inteſtines, and are there expanded. By this diſtribution, the meſentery acquires an irregular matted appearance, and as its arteries redouble and increaſe in numbers, the laſt of them makes a curvature to ſerve the ilium, and inoſculates with the ilio-colic artery.

DCCXXXVII.

Inferior.

The lower meſenteric ariſes very obliquely from the left ſide of the aorta, to which it keeps cloſe for a great way, and at the bifurcation of the aorta, it ſends off its great branch to the left ſide of the colon, viz. the left colic artery. It then deſcends to the pelvis, turning down over the iliac artery of the left ſide, and ends with the rectum.

The left colic artery, its principal branch, divides into three others, which go off from the trunk at ſhort broken-like angles. The firſt aſcends into the angle of the colon, and divides into two; the one follows the courſe of the inteſtine, and nouriſhes it; the other, running in the middle of the meſocolon, meets the upper meſenteric branch, and forms with it the meſenteric arch. The ſecond paſſes directly to the right ſide of the colon, and on approaching the inteſtines, divides into two parts, one turning up, and the other going down.

The third runs obliquely down to the part of the gut lying on the haunch bone, or the ſigmoid flexure of the colon, and from the membrane of the colon, being here connected cloſely with the loins, it gives off ſmall branches to this part, which inoſculate with the lumbar arteries.

DCCXXXVIII.

Arteriæ Hemorrhoidales.

This artery, the internal hemorrhoidal, is the trunk of the lower meſenteric within the pelvis. It is often equal in ſize to a writing quill, and is cloſely applied to the back part of the rectum, its whole length turning in over the pelvis obliquely for this purpoſe. Its large branches completely encircle the rectum, and meet on its fore part, while its lower branches inoſculate with the middle hemorrhoidal artery, and occaſionally with thoſe of the bladder and womb.

DCCXXXIX.

Such is the arterial ſyſtem of the chylopoetic viſcera, and the arteries poſſeſs correſponding veins; diſtinguiſhed chiefly by the ſame names. All theſe veins terminate in the vena porta.

DCCXL.

Having given a deſcription of the chylo-poetic viſcera, we ſhall now take a review of the leading particulars of their ſtructure. The alimentary canal, is in general compoſed of three, or, as anatomiſts for the moſt part reckon, of four different parts. The external coat is the continuation of the peritonæum; the ſecond is the fleſhy or muſcular one, conſiſting of two rows of muſcular fibres, one row being diſpoſed longitudinally, the fibres of which are exceedingly minute; but the inner layer of the fibres, the threads of which are diſpoſed circularly, is very evident. The third coat, the innermoſt one, is generally named the villous, and this is connected to the muſcular one, by what has been deſcribed univerſally as the fourth coat, under the name of the nervous; but it is rather to be conſidered as the medium ſerving to join theſe, reſembling the ſubcutaneous cellular ſubſtance, or which ſerves the ſame office to the inteſtines, that the ſubcutaneous cellular membrane does to the ſkin. In ſeveral reſpects, however, it ſeems different; it wants the fatty bags connected to the cellular ſubſtance, and the threads are ſhorter.

DCCXLI.

On inverting the ſmall inteſtines, there are a number of rugæ or doublings, on the villous and nervous coats, which make a reſiſtance to the contents, the valvulæ conniventes; by ſtretching them, we can make the gut ſmooth: but it requires ſome force to do this, and it is likely that they retain pretty conſtantly their place. Probably the villi are again leſſer valves, ſimilar to the larger; at leaſt the ſurface by means of the villi, is very greatly increaſed. The number of the rugæ, or valves, in the ſmall inteſtines, is continually diminiſhing as you deſcend, and the appearance of the villi is always in proportion to the appearance of the larger valves; and in the larger inteſtines, there is not much room for ſpeaking of either.

DCCXLII.

Where the ſmall inteſtines are joined to the larger, we find a ſtrait place, or valve, which is of a very curious texture. It might be imagined the end of the ilium with all its coats; but the external coat enters between the tranſverſe or circular fibres of the colon, which gives an oblong ſhape to the valve, and the more you diſtend the colon, the more you ſtraiten that valve, the circular fibres trying the more to bring themſelves to a ſtrait line. But beſides this, the membranes at the ſides, or ends of that valve, are put upon the ſtretch, which brings the two lips to apply to each other. So fœces lodged in the caput cœcum coli will not readily return through this valve.

DCCXLIII.

The appendix vermiformis may be conſidered as the beginning of the colon, as in the fœtus it lies in the ſame direction; but the weight of the fœces gradually puſhes it down, ſo that the appendix in the adult comes to make the ſide of the colon. In the whole tract of the inteſtines, from the mouth perhaps downwards, we find a vaſt quantity of ſlime, or mucus; and for the ſeparation of this, there are a vaſt number of exceedingly minute glands, moſt of which, and much more readily the ducts from them, from their ſmallneſs, eſcape our obſervation; but in many places we can ſee the bags containing the ſlime, as in the mouth of the ſtomach, in the duodenum, jejunum, caput coli, and in the appendix vermiformis. In ſome ſubjects they are greatly more diſtinct than in others.

DCCXLIV.

In demonſtrating the inteſtines, the ſituation of the peritonæum and its extenſions, claim particular regard. The peritonæum is a ſingle membrane, ſo far as it is to be conſidered as a membrane, and owes its double appearance to the condenſation of its cellular ſubſtance; in ſome caſes it has a morbid appearance, and we find a ſimilar appearance in other parts of the body. The cellular ſubſtance every where ties it to the other parts; and it not only lines the muſcles, but covers almoſt all the different viſcera, ſo as to give them an external coat; and if we ſuppoſe a very accurate diſſection made, and this coat ſeparated, we leave the peritonæum entire, and the bowels upon the outer ſide of it between the peritonæum and ſpine. The various ſubſtances, therefore, called ligaments, or ſupporting membranes, are merely the continuation of the peritonæum; the meſentery and meſocolon are doublings of it; but the omentum has the peritonæum quadruple. It has been deſcribed as a double membrane; and if you ſuppoſe the colon drawn away from the ſtomach, and the omentum put upon the ſtretch, it is only double; but take it as it lies over the inteſtines, or if you open the abdomen, and cut through the omentum, you cut the peritonæum four times, one doubling of it being produced from the ſtomach, and the other from the meſocolon. The ſmall omentum, however, is but double, becauſe it is formed entirely from the membranes from the liver which cover the ſtomach only.

DCCXLV.

Thus we may obſerve, that the ſmall omentum, with both parts of the large omentum, with the covering of the ſtomach, colon, and pancreas, form one great ſac, which has no communication with the reſt of the abdomen, but by the foramen of Winſlow.

DCCXLVI.

The bowels alſo have a different ſituation after we open the body from what they have in life; ſo that, though we ſpeak of the cavity of the abdomen, there-is no ſuch cavity in it as appears in a dead body; it is quite full, and does not contain above a tea ſpoonful of liquor, ſo that it is a difficult matter to open the abdomen without wounding the bowels; therefore the thruſting in a trocar is a very dangerous operation in a ſound animal, and it only becomes ſafe as in aſcites, by a collection of water, which goes between the bowels and abdomen, the meſentery and meſocolon keeping the bowels connected to the backbone, while the fore parts yield to the diſtenſion; wherever water is collected in the abdomen, it is in the cavity of the peritonæum; and, as that can be traced the whole extent of the abdomen, the water varies its ſituation according to the ſituation of the body, from this circumſtance a collection in the open cavity is diſtinguiſhed from one formed in particular viſcera.

DCCXLVII.

The ſtructure of the inteſtines or alimentary canal, is conſidered as compoſed of four different coats. The firſt coat, which it has from the peritonæum, by its ſmoothneſs allows one part to ſlide readily upon another; it does this the better, that every where from its ſurface a ſecretion is made by pores which are inviſible. For, in a ſound body, glands have never been ſeen in the peritonæum; but from every part of it we can ſqueeze out a liquor; and there is a farther addition made to this from the fat of the omentum. Next, this covering gives all the hollow bowels a very conſiderable additional ſtrength, ſo that they do not ſo readily give way to air diſtending them. Beſides, there are fewer veſſels in this membrane, whereby it is leſs favourable to concretions forming in the abdomen. We find the outer coat joined to the muſcular one by cellular ſubſtance.

DCCXLVIII.

The muſcular coat is compoſed of two layers of fibres. The external ones run along the canal, and the circular ones run tranſverſely. The effect of theſe fibres is very conſiderable, for no general preſſure of the abdomen could poſſibly puſh on the contents, and the food does not deſcend to the end of the rectum by the preſſure of the diaphragm, or abdominal muſcles; for the turns of the inteſtines evidently run almoſt as often upwards as downwards: and in diſeaſes, where a paralyſis is brought upon theſe parts, although the patient continues to breathe and exercife the abdominal muſcles, yet the alimentary canal is gorged with fæculent matter. With regard to the manner of action, it is extremely curious: but by looking into the accounts that are commonly given of this matter, one would almoſt conceive that a contraction begins at our throat, and never ceaſes till the ſubſtance is puſhed down moſt regularly from top to bottom. Now, inſtead of this, the motions are going on at different places, and in different ways at the ſame time, according to the quantity and nature of the food. The general motion, from its twiſting and compreſſing the gut, is called periſtaltic; and it is underſtood that that motion is continued from the ſtomach down to the rectum: but there naturally takes place an antiperiſtaltic motion in animals; ſo that the motion of our food very much reſembles the water in the ocean, by looking at which, you can ſcarcely determine at firſt whether it is coming in or going out, only there is, upon the whole, a greater motion the one way than the other. Thus, in the alimentary canal, the food is puſhed on a certain way, then it is turned back a little, then it goes on again, and the two layers or fibres are both employed, but they act differently; the longitudinal fibres ſhortening the canal, and the circular fibres ſtraitening it. Thus, when a morſel of food is taken down, the firſt thing is the ſhortening of the tube by the contraction of the longitudinal fibres; then the circular fibres contract chiefly from above downwards, and the food is puſhed on a conſiderable way. The longitudinal muſcles acting firſt, draw the gut upon the food, when the other fibres act with more advantage; and the longitudinal have the advantage of being fixed at the upper end by the contraction of the circular fibres.

DCCXLIX.

The uſe of the antiperiſtaltic motion is evident, that nature means not only to prepare, but to turn the food over and over, ſo as to expoſe every part of it to the mouths of the veſſels which are to receive it; and this is done in a much more accurate manner, and there is a much cloſer exertion of every fibre than many are aware of. We are by no means to apply the rules here that have been laid down with regard to muſcles, that they are ſo many bladders, and only contract to a certain degree; for here they contract in ſuch a manner as to ſhut the paſſage altogether. Thus, if a perſon ſwallows a ſmall quantity of quickſilver, in a ſhort time it goes through the whole canal, which it cannot poſſibly do by means of its weight, on account of the ſeveral turns it makes, and it muſt be puſhed down by the ducts contracting ſo cloſely as to bring the oppoſite ſides together. In conſequence of the agitation our food ſuffers here, it is probably farther diſſolved, and perhaps the general tendency to putrefaction is in ſome meaſure prevented; alſo, a new combination takes place, the great preſſure occaſioning the pouring out of liquors to animalize the food, and perhaps to diſſolve it, like menſtrua. The feculent matter is puſhed downwards to be diſcharged from the body, while the uſeful parts are received into the lacteal veſſels, they are ſucked in in the manner to be afterwards explained: but once theſe veſſels are filled, the muſcular coat comes to be contracted, and being crowded with valves, the food is puſhed onwards towards the heart, and this is done with conſiderable force; for, after tying the lacteal duct, there is obſerved an effuſion of the chyle about the meſentery, by a rupture of the larger veſſels.

DCCL.

Within the muſcular coat we find the nervous and villous coats, the nature of which has been very generally miſunderſtood. Authors have compared the villous coat to the cuticle upon the ſurface of the body: but this is altogether improper, and it leads to another miſtake; for, in conſequence of this, the nervous coat is ſuppoſed to repreſent the ſkin, but it is with the utmoſt difficulty that we can ſhew very minute nerves reaching any part of the nervous coat. Now, inſtead of this, the villous part repreſents not only the cuticle, but the cutis vera; the inſenſible ſkin on the inſide is much thinner than the cuticle, and is ſhewn with difficulty. The villous coat is beyond all doubt ſenſible, having both nerves and blood veſſels.

DCCLI.

The nervous coat may be compared to the ſubcutaneous cellular membrane; only it does not contain, or ſuſpend fat: hence it is a pure cellular ſubſtance. It is much more denſe too, having much ſmaller cells; theſe, however, communicate, and, upon the whole, it ſerves the ſame purpoſe, allowing the villous one to play eaſily, and alſo conducting its coats and nerves.

DCCLII.

Theſe two inner coats form what is called valves, the valvulæ conniventes; and, again, each of the valves is ſubdivided into villi, which may be conſidered as ſerving nearly the ſame purpoſe, viz. adding to the ſurface. They are not to be conſidered as the mouths of one, or two veſſels, but as a fold of the inner coat. Upon the whole, we ſee nature endeavours to lengthen out the inner coat much more than the outer, and the rugæ make a greater difficulty to the paſſage of the food, ſo that it is retarded till it is fully prepared, and applied ſufficiently to the ſurface of the inteſtines.

DCCLIII.

To defend the alimentary canal from the acrimony of the ſubſtances we take in, there is a vaſt quantity of mucus ſecreted, we can in ſome places obſerve the ſmall bags or follicles in which it is contained; and what we ſee in ſome few places, we preſume to take place in all.

DCCLIV.

After this general ſtructure, we conſider more particularly the different parts of the canal, beginning with the æſophagus. The æſophagus perforates the fleſhy part of the diaphragm. One uſe of which is very evident, and material. Had it paſſed through the tendinous part, the contents of the ſtomach would have been eaſily thrown back into the mouth; whereas, by going through the fleſhy part, and that ſwelling when the diaphragm aſcends, the regurgitation is prevented, not that it is entirely ſhut. A liquor can be ſwallowed when an expiration is made; but it is made with difficulty.

DCCLV.

From the ſituation of the ſtomach with reſpect to the other viſcera, can be underſtood what is very often obſerved to happen in practice, that communications are made by eroſions from one bowel to another. Such communications may have different effects, according to its direction. Thus, they may be ſlanting, ſo as to allow liquors to go only one way, as in the caſe of the gall-bladder, where there is ſuch a ſlanting direction, for we can blow in air into the duodenum without diſtending it.

DCCLVI.

Some circumſtances with regard to the emptying of the ſtomach, and the filling of it, deſerve attention. There are very evident longitudinal fibres, and within theſe circular fibres; there is particularly a band of longitudinal fibres running along the ſmall curvature. Inſtead of the ſtomach lying in a line with the æſophagus, when it is diſtended, it comes forwards, ſo as to make an angle with it, which ſerves too, to prevent our food, by a moderate preſſure, from being thrown upwards into the mouth, and the pylorus is turned up or raiſed higher, and theſe membranes have the effect of ſtraitening both orifices conſiderably, eſpecially the cardia. So in vomiting, the pouring in a very great quantity of liquor, by diſtending the ſtomach to a great degree, may ſhut theſe orifices, and ſo endanger a rupture of the ſtomach; and that this does not frequently happen, is owing to this, that every one bowel ſupports another. All here are ſupported by the containing parts. The pylorus is raiſed upwards when the ſtomach is diſtended, for a very evident purpoſe; for if it had hung down, the more it was diſtended, the indigeſted aliment would have got out, whereas it is only the lighter parts that aſcend and get out, and that ring at the pylorus is not merely compoſed of coats, but is really a circular muſcle, or ſphincter, which acts ſo vigilantly, that you will ſcarce find indigeſted food in the inteſtines. We know that ponderous bodies will paſs down from the ſtomach, and that gall ſtones will be thrown up by vomiting. Then the ſituation of the pylorus does not riſe ſo high as the other orifice, but it is ſituated obliquely, and turned backwards. As we have found that the alimentary canal in general enjoys an antiperiſtaltic motion; ſo in the ſtomach, there is a working from the right towards the left, as well as the other way, but very gently for ordinary. If, however, a very irritating ſubſtance be introduced by an inſtinct of nature, the antiperiſtaltic motion comes to be ſuperior to the periſtaltic, and by this means the contents of the alimentary canal may be brought from the lowermoſt part of it upwards. Vomiting, therefore, may be explained in this manner: A nauſea is produced, and the motion of the ſtomach is inverted, we act with the diaphragm in a ſlow manner, ſo as to puſh down the ſtomach, whereby we put the abdominal muſcles upon the ſtretch; theſe are thrown into a convulſive motion, and the diaphragm yielding gently, while the matter is thrown up, the air is thrown out at the ſame time, ſo that the water, when thrown up, is generally mixed with air.

DCCLVII.

The inteſtinal canal we formerly conſidered as divided by anatomiſts into the ſmall and great inteſtines, and theſe are again farther divided. The inteſtine connected with the ſtomach, is from its length named duodenum. It is tied down very cloſely to the poſterior part of the diaphragm, by a cellular membrane wanting a meſentery, and of courſe wanting that very cloſe covering which the continuation of the meſentery gives; while this is ſupplied, in ſome meaſure, by the courſe it takes. From the greater ſize of that inteſtine than of theſe that immediately follow, it has been termed the ventriculus ſuccenturiatus, and perhaps the more this idea is conſidered, the more juſt it will appear; for, beſides the cloſe adheſion for ſupporting the ſtomach in its place, we obſerve that liquors of great importance, the bile and pancreatic juice are poured in here; and, in order to retain theſe longer, that they may be better incorporated with the food, that inteſtine, without neceſſity, makes ſeveral ſhort turns, ſo that the food muſt undergo very conſiderable alterations here. As ſoon as the duodenum has got to the left ſide, it turns almoſt quite downwards; and now the meſentery begins to be added, and it gets the name of jejunum, and from this the ilium is continued, and the upper end of the jejunum is conſiderably wider than the lower end of the ilium; or, the tract of our ſmall inteſtines is ſomewhat of the conical ſhape, with the larger end of the cone upwards.

DCCLVIII.

A difference of colour is alſo obſerved here. The jejunum is always a great deal redder coloured, for the coats are, in proportion to the greater diameter of the canal, thicker, and there is a greater number of veſſels in the jejunum that circulate the blood. When it is laid open, we find the valvulæ conniventes more remarkable; and the villi, or farther diviſion of the ſeveral valves, likewiſe larger. Every one of theſe circumſtances may be accounted for upon the moſt ſimple principles. There is a greater quantity of food paſſing through the jejunum than the ilium, ſo the feculent matter, as it deſcends, becomes more conſiſtent, and is more obſerved in the ilium. Hence the neceſſity that a greater ſurface ſhould be applied in the jejunum, for the ſeparation of thoſe liquors from the blood, which ſerve to animalize and diſſolve the food. The ſurface is increaſed for the purpoſe of greater abſorption; and, for the better execution of both, the valves are made larger to ſtop the too eaſy paſſage of the food. Deſcending downwards, the meſentery becomes ſomewhat looſer, and the bowels are more moveable; but there is, by no means ſuch a change of place as appears in a dead body.

DCCLIX.

From the great length of the meſentery, eſpecially of the lower parts of it, we can conceive two circumſtances poſſible. That the meſentery and gut may be twiſted by a violent exertion; and, if the omentum is of an unuſual length, and there is a great quantity of fat, this may in like manner entangle the inteſtine, being twiſted round a portion of it.

DCCLX.

The end of the inteſtinum ilium enters the great inteſtine; and of late years it has been propoſed, that in certain caſes, where one part of the inteſtine falls within another, attempts ſhould be made to diſentangle them, by throwing injections into the colon.

DCCLXI.

In the appendix vermiformis, the mucous pores are comparatively very large; and it probably, therefore, ſerves to ſecrete a quantity of mucus to be added to the feculent matter; and in the greater part of the ape kind, where that is wanting, it is ſupplied by a ſpongy ſubſtance, immediately under the valve of the colon.

DCCLXII.

From the appendix vermiformis the three ligaments come out, and this part is to be conſidered as the bottom of the caput cæcum coli, its ſituation being altered by the weight of the matter and by uſe; and the advantage of this is, that the fibres ſhould all come from one point; for theſe being all in action at the ſame time, and this part being tied down by the peritonæum paſſing over it without a meſocolon, the other parts of the colon are drawn towards that for the ſhortening of the inteſtine by means of the longitudinal fibres; and the colon, from the ſeveral turns it makes, is contiguous to almoſt all the abdominal viſcera, which is a circumſtance that ought never to be loſt ſight of, otherwiſe very conſiderable miſtake may take place in judging of diſeaſes, or in treating them.

DCCLXIII.

In examining the relative uſe of the different parts of the inteſtines in reſpect to our aliment, we obſerve that the ſmall inteſtines are intended to promote the formation of chyle, to allow it to be abſorbed, and to propel the remains of the food into the next diviſion, or large ones. That, by the next diviſion, viz. the cæcum and beginning of the colon, the food received from the ilium is retained for ſome time; and in conſequence of farther abſorption, acquires a greater degree of conſiſtency, and receives alſo a fœtid ſmell; that in the colon, the excrementitious part alone is received, retained, and changed into fœces; and, by the periſtaltic motion of the inteſtines, and the power of reſpiration, they are puſhed by ſlow degrees into the rectum. In the rectum, the fœces are retained a certain time; till, by their weight and acrid nature, it is ſtimulated to diſcharge them, which it does by the power of its muſcular coat, and of the levator ani, aſſiſted by the diaphragm and abdominal muſcles.

END OF THE FIRST VOLUME.

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